March 7, 1945

NATIONAL PETROLEUM NEWS

TECHNOLOGY DEPT.

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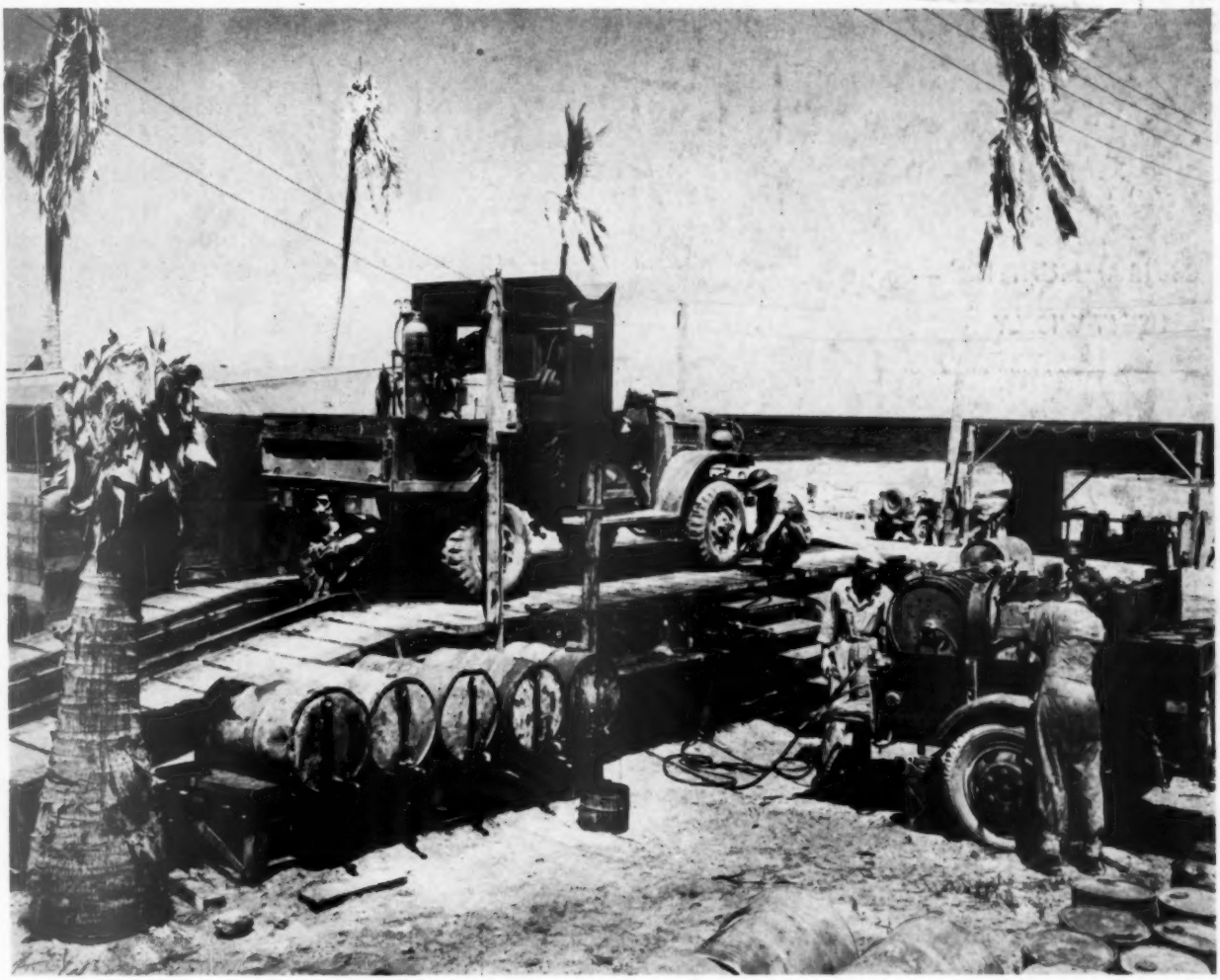
Versatile Seabees Construct Grease Rack at Eniwetok



Official U. S. Navy Photo

Demonstrating their ever-present ingenuity, Navy Seabees build a wooden grease-rack on Eniwetok. The structure cuts a great deal of time from the period required to service vehicles

Highlights in This Week's NPN—

A. P. I. Aviation Committee Named: William R. Boyd, Jr., president of A. P. I., appoints prominent members of the industry to a committee to advise the institute's officers and standing committees on developments and trends in aviation . . .p. 5

Revived Salesmanship Will Rebuild America: E. J. Gallmeyer, vice president and sales director of Wayne Pump Co., delivers a timely reminder to all industry in a speech at Cleveland . .p. 4

Recapping, a Giant Today, but What of Tomorrow? Herb Taylor completes the second of two articles on a subject of interest to all marketers . . . p. 18

REFINERY MANAGEMENT AND PETROLEUM CHEMICAL TECHNOLOGY EDITION—In 2 Sections, Section 1

MORRISON BROS. CO.

LINE STRAINERS

OIL IS AMMUNITION —
USE IT WISELY

Every Truck Tank, Pipe Line and Pump will be more efficient with Morrison Bros. Co. LINE STRAINERS.

These improved strainers completely eliminate all foreign materials that hinder the operation of pumps, meters and pipe lines.

Fig. 286

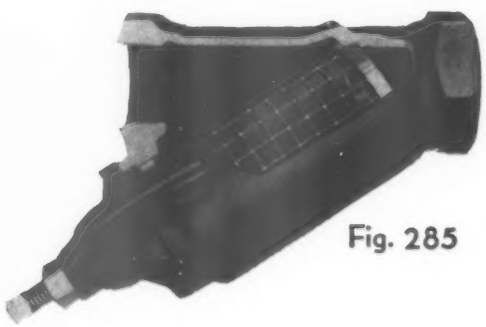
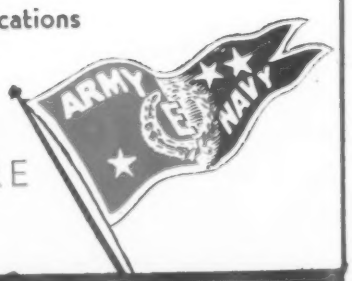


Fig. 285

Write for Prices and Specifications



BUY STILL MORE BONDS

MORRISON BROS. COMPANY

OIL EQUIPMENT HEADQUARTERS

DUBUQUE, IOWA

HAVE YOU HEARD . . .

About Republic's post-war plans? Plans that will be as streamlined for profit as new modern designs will be streamlined for speed.

It was transportation that changed the Nation's living habits after World War I. New industries mushroomed; Tourists' camps; road building; country clubs; truck freight. Other industries withered and died. Wagons; harnesses; blacksmiths.

Post World War II era will also bring changes. And with these changes will come new living habits, new opportunities in life, new roads for profit, a new era in the history of transportation—and petroleum.

Now being developed in the petroleum industry, are gasolines and fuels for more speed, more power, more efficiency—producing miracles for America in war—later to take a natural place in normal American life. Republic will pass the benefits of these developments on to the public through its dealers and jobbers. It's wise to work with Republic.

REPUBLIC'S GOING PLACES

REPUBLIC OIL COMPANY

Benedum Trees Building Pittsburgh, Penna.

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George H. Taber, Jr. . . .

New Sinclair Chief Born Into Oil Business

GEORGE H. TABER, Jr., Sinclair Refining Co.'s new president was literally born into the oil business. His father was a director of the Gulf Refining Co. until his death five years ago and had been a vice president of the company until his retirement in 1928.

Mr. Taber Jr.'s elevation to the presidency last November was the culmination of 28 years of service with Sinclair. He joined the company in 1917 and in the years since he has held many important posts, including manager of the natural gasoline department, vice president Sinclair Oil & Gas Co., president of the Sinclair Crude Oil Purchasing Co. and in 1923 was made vice president of the company he now heads.

Born in Franklin, Pa., on Jan. 4, 1890, Mr. Taber attended public schools in Pittsburgh and Philadelphia and in 1911 received a Bachelor of Science degree in mechanical engineering from the University of Pennsylvania. In 1913, he received his master's degree in chemical engineering from Massachusetts Institute of Technology.

Like his father, Mr. Taber has developed and patented many improvements in petroleum refining. The elder Taber is credited with being the first refiner to use fuller's earth for filtering lubricating oils instead of bone black which long had been exceedingly disagreeable and troublesome to handle.

Member of the American Society of Mechanical Engineers, Mr. Taber recently accepted membership on the board of directors of the American Standards Assn. He is a member of the Society of Automotive Engineers and the American Institute of Mining and Metallurgical Engineers.

He also is a member of PAW Dist. 1's refining committee.

If you ask him if he has any hobbies, he'll hesitatingly tell you: "Yes, I like to hunt and fish and transplant wildflowers. But all that's out the window these war days. I hope some day, when the war's over, to be doing it again."

Mr. Taber lives at Rye, N. Y., with his wife and two children, a boy and a girl.

BULLETINS

OREGON GETS ALCOHOL PLANT

WASHINGTON—The first plant in America for large-scale production of ethyl alcohol from sawdust and other wood waste will be in operation this summer at Springfield, Ore. It will produce 4,100,000 gal. of alcohol annually for vital war purposes, including manufacture of synthetic rubber.

Rep. Harris Ellsworth (R., Ore.) made that disclosure this week in an address to the House in which he asked that Congress inventory the nation's wood-research program and make plans for its continuation postwar.

The Springfield plant, authorized by WPB, will be operated by the Willamette Valley Wood Chemical Co. Selection of the site was made by the U. S. Forest Service as the best of a dozen localities in Oregon and Washington state where sufficiently large quantities of wood waste are available to support a full-scale plant.

24 TANKERS IN FEBRUARY

WASHINGTON — U. S. shipyards delivered 24 tankers during February, the Maritime Commission announced today. Deliveries by yards were: Sun Shipbuilding and Dry Dock Co., Chester, Pa., five T2 tankers; Alabama Dry Dock and Shipbuilding Co., Mobile, five T2 tankers; Bethlehem-Sparrows Point shipyard Inc., Sparrows Point, Md., one naval tanker; East Coast Shipyards Inc., Bayonne, N. J., two naval tankers; Kaiser Co., Inc., Swan Island Yard, Portland, Ore., five T2 tankers; Marinship Corp., Sausalito, Calif., four T2 tankers, and one naval tanker, and Welding Shipyards, Inc., Norfolk, Va., one T3 tanker.

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NATIONAL PETROLEUM NEWS
NPN
NEWSMAGAZINE FOR OIL MANAGEMENT MEN

OPA Starts Crackdown on Midwest Firms; Sues Five, Charging Group 3 Price Misuse

Damages Totaling $219,647 Asked of Texaco, Sinclair, Globe, Hughes and Northwestern; Says Real Figure May Be Higher

NPN News Bureau

CHICAGO — OPA's crackdown on Midwest refiners and oil companies, which has been pending for some time, began on March 3, with the filing of three suits in Federal District Court here, another in Hammond, Ind., and a fifth in St. Paul, Minn.

All the suits allege violation of OPA price ceilings under MPR 88 as amended, for a total of $219,647.22, covering treble damages. OPA emphasizes that this amount is the minimum and is based upon sample checks of records of the companies and that the amount may be materially increased after full accountings, which are asked in the suits.

Companies involved and damages asked are: The Texas Co., $5,275.44; Hughes Oil Co., $6,048.24; Globe Oil & Refining Co., $104,668.86; Sinclair at Hammond $101,676.90; Northwestern Refining Co., at St. Paul, $1,977.78.

Cases against other oil companies, OPA said, will be filed within the next few days.

In the suits filed, OPA charges that the companies failed to maintain adequate records available for OPA inspection, showing the basis of the determination of maximum prices, and asked the court for injunctions requiring maintenance of such records, and a second injunction restraining the further sale of products after 30 days from date of the court's order unless the companies have prepared and made available to OPA adequate pricing records as provided in sec. 1.12 of MPR 88.

Charge Failure to Report

In addition, Northwestern Refining Co. was charged with failure to file OPA Report Form R-1119 on fuel oil for a period of seven months and Form 550 on gasoline for period of eight months, and with having transferred fuel oil without collecting ration evidences.

The specific charge in the complaint against The Texas Co., based on a sample check of records by OPA, is on the sale of kerosine and furnace oil to three purchasers between March 1, and October 31, 1944, for $1,758.48 in excess of ceilings.

Hughes Oil Co. sold No. 3 furnace oil to one customer during the period from Jan. 1 to Nov. 30, 1944, at $2,-625.68 in excess of its maximum price, OPA said in bill of complaint against that company. OPA explained to NPN, however, that the statute of limitations was one year, and that the agency's claim for treble damages in this case was based upon excess charges of $2,-016.08 made between March 1 and Oct. 31, 1944.

Globe Oil & Refining Co. allegedly sold and shipped 11,036,715 gallons of gasoline, 1,392,414 gallons of range oil and 1,018,080 gallons of T-40 tractor distillate to one purchaser between March 1 and Nov. 30, 1944 for $34,-889.62 in excess of ceiling prices, treble damages figuring out to $104,668.86.

The suit against Sinclair is based upon claim that the company sold No. 355 diesel fuel to 14 purchasers at a single shipping point for $39,051.21 above ceiling.

William E. Remy, OPA fuel and durable goods enforcement director, who is holding a national meeting of his regional enforcement personnel here this week, in commenting on the OPA price violation suits, said that he anticipated some of the companies would reply with pleas that OPA was forcing a change in industry practice of Group 3 pricing. However, he asserted that was not a fact and that OPA's charges were based upon excesses over and above actual prices at which products were sold during the base period upon which ceilings were determined.

Enforcement Meeting Routine

"Companies which, during that period, sold and shipped from Group 3, plus freight, and are still doing the same things, as provided in the regulations, are not now and have not been in violation," he said. "Companies that were underselling the Group 3 market during the base period made their bed," he continued, "and now they should be willing to lie in it."

He said the enforcement meeting he is now conducting here is routine, merely to bring the OPA attorneys up to date on regulations, and is not related to the suits.

Fuel Oil Distributors And OPA Harmonize

WASHINGTON—OPA this week met with its 8-man fuel oil distributors panel to review regulations, particularly as they affect dealers.

The meeting closely paralleled one held the week before by OPA with its fuel oil council (*see NPN Feb. 28, p. 6*), covering same technical questions.

The dealer "balance" report, Form 1198, was talked over and it was agreed that the next filing date, April 1, should not be changed. However, an early amendment is expected to provide that any dealer with a shortage who wishes to apply for a bail-out must do so before May 25.

In addition, one part of Form 1198, dealing with void evidences which dealer has on hand, will be stricken from the form, since OPA will soon order all dealers to return to the rationing agency all void evidences they have in their possession.

It is hoped that very few types of rations will be issued this summer for the 1945-46 season. They will probably be: new type 3-A class coupon strips (for miscellaneous fuel oil and kerosine uses), ration checks by large users with ration bank accounts; regular coupon sheets used by homeowners and other small consumers, and forms used by the military for fuel oil purchases from dealers.

OIL-MARKETERS CONVENTION IN PRINT COMING

NPN News Bureau

CLEVELAND—The biggest oil marketers convention in history is in the making. Hundreds of marketers will participate to help oil jobbers with their 1945 problems.

And War Mobilization Director Byrnes will like this convention.

It's the world's first Oil-Marketers-Convention-in-Print. It will be conducted through the pages of NATIONAL PETROLEUM NEWS. There will be:

Nationally known speakers-in-print.

Informal discussions of many phases of the oil marketing business.

Talks-in-print by marketers, telling how they are meeting today's problems and their plans for the future.

Latest developments in the equipment field will be told.

In addition to the serious problems, the lighter side of the meetings—traditionally a part of oil men's conventions—will be told.

The program of this Oil-Marketers-Convention-in-Print will be announced in the March 21st NPN. Also the name of the chairman who will conduct the meetings, introduce the speakers, keep the proceedings in order.

Make YOUR reservation now. Get ready to speak your mind by letter on today's oil marketing problems if you don't agree with what the other fellows say.

Postwar Jobs and Prospects—

Revived Salesmanship Will Rebuild America, Gallmeyer Says

Wayne Pump Co. Vice President Tells Cleveland Groups Pent-Up Buying Power Will Exist But Goods Must First be Sold

NPN News Bureau

CLEVELAND—E. J. Gallmeyer, vice president and director of sales, Wayne Pump Co., was the guest speaker at the March meeting of the Petroleum Club of the Cleveland Chamber of Commerce March 5. Members of the Sales Executive Club of Cleveland were guests at the meeting, which was held in the ballroom of a downtown hotel.

Mr. Gallmeyer declared that American industry is "going somewhere because it has been some place." He said that the essential difference between the United States and other countries is its ability to sell and distribute goods.

"We saw our nation lifted out of the mud and placed upon ribbons of concrete by the automotive industry of America" he said. This was accomplished by salesmanship, which built America, and it will rebuild it, he asserted.

Doubts 60 Million Jobs Needed

On the subject of finding employment for 60,000,000 people in the postwar era, Mr. Gallmeyer contended that no one knows whether we need to furnish 60,000,000 or 50,000,000 jobs. He said it was a fallacious notion that all the men in the armed forces have to be absorbed by industry, pointing to statistics that show fewer than 25% of the men in the armed forces came from industry. He said that industry will assume its share, and more, but he questioned industry's obligation to absorb all the men in the armed forces.

He said that American salesmanship has the "know how" which can be applied immediately to rebuilding America. The country has the technically trained men to train others to sell, he said.

"Salesmanship and coverage are the shibboleth of modern American merchandising, and the nucleus around which a great sales armada will be rebuilt in this country," he said.

Sales Muscles Grown Soft

Mr. Gallmeyer said that as a result of inactivity, our sales muscles have not been active. In some cases, he said, those in the sales department had not only "grown fat around the waist, but have let some of it go to their heads."

"Let's not be the victims of our own genius," he warned. "We know that the psychological sales program follows the old couplet—first we abhor, then we tolerate, then we embrace."

Restudy Old Techniques

Now is a good time to go back and study anew some of the techniques and some of the systems and some of the things that we once were familiar with, Mr. Gallmeyer said, promising that the brushing up will re-enthuse us. He said he had a sneaking feeling that we are going to be short of help within three years after the war is over. "The magnificent job being done by Paul Hoffman and his committee of Economic Development, the fact that we are here talking about it today, and the fact that people and jobs are the subject of conversation far and wide throughout the nation, is the finest safeguard against a debacle."

"But bear in mind that this job has to be done through selling and this brings me to the third phase of my brief discussion here today. Gentlemen, you all know that there is a lot of welled up buying power in our nation. I don't know, nor does anyone else, whether we need 10,000,000 homes or 15,000,000 homes; whether the American railroads need a million new cars and locomotives and pieces of equipment, or whether it is two million.

E. J. Gallmeyer

Market Pores Are Open

"I don't know whether the American public will absorb 10 or 15 million new automobiles in the first five years after the war. Certain it is that my friend, Whittlesey, here of Sherwin-Williams Paint Co. can tell us that right now the market is just dry and ready to open its pores and become saturated.

"Added to this, we have as an ally the American developed appetite. Now, what do I mean by that? I mean simply that through the radio and through moving pictures and through our general publicity and our educational system, in fact, we have whetted the appetites of American men, women, and children, for all of the modern conveniences that it is possible for them to embrace. We have improved their tastes. The American people have learned during the recent years to eat higher on the hog than ever before, and that is also true of the quality articles that they have absorbed.

"With the rationing system they have not bought the product that was offered at the lowest price, but they have bought a better article, and this discovery that quality in the end is the most economical, will undoubtedly stay with them.

Lauds Deferred Payments

"We have the welled up capital to supply all of these needs also. There is no question but what there is a lot of additional cash, but I know lots of people who have had a little cash for the first time are not going to just dish it out for everything that might be offered. I believe that they will avail themselves of credit extension. I think that the American industrial development of the payment plan will be reinstituted in large measure, and rightly so, for during the panic the one class of paper that paid out almost one hundred cents on the dollar was the deferred payment contract.

"And so with this welled up and developed appetite in America; with the 'know how' in connection with our sales genius; with the funds available to aid people in owning, there is no reason but what the accumulated American talent which took our American genius for invention and coupled it with our marvelous manufacturing facilities and capped it with the finest sales and merchandising methods the world has ever known, cannot repeat in the postwar period.

"But, Gentlemen, we could have had it the other way, too, and without sales there would have been only stagnation. Those who would employ 60 million people and enter headlong into a program of production, irrespective of what ultimately would become of the commodities so created, are just unsound in their thinking.

The Music of Business

"Merchandising and selling come first. True, all of the manufacturers in America are going to build equipment for stock right away, but unless that stock is moved rather readily and unless that stock is kept moving, the channels of distribution and warehouses choke up in a hurry and the surplus capital is tied up and there will be a short-lived employment if merchandising is not emphasized.

"Gentlemen, salesmanship is the music of business. When the band stops playing, the soldiers march with greater fatigue. Right now I think the sales fraternity of the nation needs a stimulation of its spirit. We have laid off so long, the brakes have been on us for such a long time that many of us have

lost our cud, or our enthusiasm and spirit have abated. Yes, my friends, we need a spiritual revitalization—and I say to you that spirit is the biggest word. Emerson said, 'Beware what you set your heart upon for it surely shall be yours.' American salesmanship set itself high goals and it achieved those goals. Postwarwise American sales genius and American sales power say to the American people: 'We understand this job. We know how to organize for it. We will accomplish it for—men of spirit make the times serve them.'"

R. J. Babor Resigns PIC Post To Return to Richfield

NPN News Bureau

NEW YORK—R. J. Babor, general manager of supply and transportation of the Supply and Transportation Committee of the Petroleum Industry Committee, Dist. 1, has resigned, effective March 15, and will return to Richfield Oil Corp., where he was manager of supply and transportation until he left in February, 1944, to join PIC.

Mr. Babor's resignation was originally scheduled for Feb. 15, when both he and Richfield had hoped he could resume his former private post, but the change was postponed, pending the selection of a successor in PIC.

'Gas' Coupon Counterfeiters Get 3-Year Prison Terms

NPN News Bureau

LOS ANGELES—Two men were sentenced to three years in prison by a federal judge here last week for counterfeiting and possessing 2240 gasoline ration coupons.

The men, Jesse M. Carney and Milton G. Ramsey, allegedly were caught in the act of printing the counterfeit coupons last December in a Los Angeles garage. Officers seized a printing press, with counterfeit coupons, and enough paper to print millions of gallons worth of fake stamps.

The judge denied an application for probation.

OPA Cites 67 Midwest Stations In Suit on Naphtha Sales

NPN News Bureau

CHICAGO—Suit has been filed in Federal Court at St. Paul, Minn., by OPA charging 67 service stations in Minnesota and five other Midwestern states with violation of gasoline price regulations. The station operators sold naphtha for automobile use, Rae E. Walters, OPA regional Administrator, said here on Feb. 28 in announcing the filing of the suit.

The naphtha was distributed by Tankar Gas, Inc., from Minnesota and was sold at 25c a gal., according to Mr. Walters, who said the price was excessive, adding that it was believed that the recent amendment to OPA regulations bringing light naphtha under rationing had closed all loopholes to use of the product for motor fuel. This suit indicates, however, that the amendment was not 100% effective.

Committee Is Appointed To Guide A. P. I. on Aviation Developments

NPN News Bureau

NEW YORK—Reflecting the interest of the petroleum industry in postwar aviation development, is the announcement by William R. Boyd, Jr., president of A.P.I., of the appointment of a committee on aviation.

This committee will function as a standing committee advisory to the board, executive committee and president of the institute on over-all policies and procedures of appropriate interest and proper concern to the petroleum industry related to aviation.

Named as chairman was W. Alton Jones, president of Cities Service Co., and as vice chairman, Bert I. Graves, vice-president of Tide Water Associated Oil Co. Both are directors of the institute. Mr. Jones is a member of the executive committee.

Mr. Boyd said:

"The Committee will co-ordinate its activities with any other A.P.I. Committee having an interest in the subject of aviation and in particular the Institute's American Petroleum Industries Committee. In order to effectuate close co-operation between the Committee on Aviation and the American Petroleum Industries Committee of the API, its Chairman, (W. Alton Jones, with Bert I. Graves as alternate), is appointed, ex-officio, a member of the A.P.I.C. and the Chairman, (Edwin S. Hall), and the Director, (Baird H. Markham), of that Committee are appointed members, ex-officio, of the Committee on Aviation.

"The committee will establish and maintain contact with agencies of government, the aviation industry and others who are conducting properly authorized discussions and studies about aviation development.

"Postwar aviation development, and legislation affecting it, will be of tremendous interest to the petroleum industry. Safety, traffic control, taxation, aviation fuels and lubricants and likely numerous problems of engineering and technology are among the things that naturally suggest themselves as being of interest and concern. The future of aviation and its relationship to the petroleum industry are very live subjects and it is to advise with respect to general policies of appropriate interest and proper concern that this standing Committee is created."

The committee will hold its initial meeting at a time and place fixed by Chairman Jones.

Following is a list of those named to the new committee:

W. Alton Jones, Chairman, president, Cities Service Company; Bert I. Graves, Vice Chairman, Vice President, Tide Water Associated Oil Co.; Hines S. Baker, Exec. vice president, Humble Oil and Refining Co.; Col. Thos. H. Barton, president, Lion Oil Refining Co.; R. F. Bradley, Standard Oil Company of California; Paul G. Blazer, Chairman of the Board, Ashland Oil & Refining Co.; H. E. Brandli, vice president, Cities Service Oil Co., Inc.; C. C. Carpenter, Union Oil Co. of California; J. W. Connolly, director, Standard Oil Co. of New Jersey; H. W. Dodge, Vice President, The Texas Company.

James E. Dyer, Vice President, Sinclair Refining Co.; Sylvester Dayson, president, Premier Refining Co.; Walter L. Faust, Vice President, Socony-Vacuum Oil Co., Inc.; D. P. Hamilton, president, Root Petroleum Co.; W. V. Hartmann, Vice President, Gulf Oil Corp.; Charles F. Hatmaker, Vice President, Pan-American Petroleum & Transport Co.; H. E. Hanson, Standard Oil Co. (Indiana); P. E. Lakin, vice president, Shell Oil Co., Inc.

Bernard L. Majewski, vice president, Deep Rock Oil Corp.; John W. Newton, vice president, Magnolia Petroleum Corp.; Will D. Parker, Phillips Petroleum Co.; Arthur E. Pew, vice president, Sun Oil Co.; M. H. (Bud) Robineau, Frontier Refining Co.; O. D. Robinson, president, Republic Refining Co.; A. A. Stambaugh, Vice president, Standard Oil Company (Ohio); C. B. Watson, Vice President, Pure Oil Co.; Wayne C. Yeager, Vice President, Atlantic Refining Co.; William S. Zehrung, president, The Pennzoil Co.

Ex-officio members are Edwin S. Hall, Chairman, American Petroleum Industries Committee of the API, and Baird H. Markham, director, American Petroleum Industries Committee of the A.P.I.

Oil Workers Union Asks To Take Hand on Treaty

Special to NPN

FORT WORTH, Tex.—A request for representation at future oil treaty conferences has been made by the Oil Workers' International Union (C.I.O.).

O. A. Knight, president of the union, in telegrams addressed to President Roosevelt, Sen. Tom Connally, and Interior Secretary Ickes said:

"On behalf of the 70,000 workers represented by the Oil Workers' International Union, I am asking that labor be represented at future dealings with postwar petroleum relations.

"The oil companies have been fully represented at such conferences. We have no objections to that. They have billions of dollars invested which they seek to protect. The oil workers, however, have their lives invested in this industry. Their future livelihood and well-being of their families will depend to some measure on relations worked out with Britain and other oil-producing nations."

Knight also asked labor representation in the United Nations delegation at the San Francisco conference in April.

PIPELINES—*Views of the Industry's Problems a*

Washington— *U. S. Law May Solve Sherman Act Problem in Oil Pact* —By Herbert Yocom

WASHINGTON—Regardless of the final presence or absence of antitrust language in the Anglo-American Oil Treaty, it is now pretty generally agreed by all here concerned that the Sherman Act matter is one that will have to be dealt with legislatively by Congress very soon after ratification of the agreement has been completed.

Mr. Yocom

Preliminary thinking in this connection suggests the desirability of a congressional enactment similar in many respects to Section 12 of the Small Business Act, with which all in the petroleum industry are familiar. This, of course, is the section which authorizes the procedure under which the chairman of the War Production Board certifies that the doing of certain acts or things are requisite to the prosecution of the war and are exempt, therefore, from prosecution under the antitrust laws.

With respect to the oil treaty in its relation to the Sherman Act, the need appears to be for Congress to designate an agency of government to pass on the recommendations of the International Petroleum Commission and to prescribe the standards or policies that are to guide the agency in reviewing such recommendations. Only those proposals of the commission which met the test prescribed by Congress could be approved by the agency for certification to the petroleum industry.

° ° °

According to a report in the *Washington Post* Henry A. Wallace, in his new job as Secretary of Commerce, may soon also find himself in control of the Federal Power Commission and three other independent agencies—Interstate Commerce Commission, Securities and Exchange Commission, and the Federal Trade Commission.

The way the *Post* hears it, an order transferring jurisdiction over the four agencies has already been drawn up at the Budget Bureau and will be issued soon over the signature of the President. Concludes the *Post*:

"However, the official word from a Wallace spokesman, was: 'We know nothing about it and we doubt if the report is true.'

"In other quarters, though, the transfer rumor was described as 'plausible.'"

° ° °

First official act, incidentally, of Mr. Wallace, after being sworn in as Secretary of Commerce, was to appoint a committee to study ways and means of making adequate equity financing and long-term loans available at reasonable rates to small business.

Membership of the committee, which was drawn from the department's Industry Advisory Council, includes such familiar names as U. S. Chamber of Commerce President Eric A. Johnston; former OPA Administrator Prentiss M. Brown, now board chairman of the Detroit Edison Co., and Stacy May, the McGraw-Hill official who served as chairman of that National Planning Assn. committee which suggested last November (*see Nov. 29 NPN, p. 3*) that the U. S. would be importing a billion barrels of oil per year by 1950.

° ° °

According to Rep. Anderson, of California, the Navy's net cash income from Elk Hills reserve operations at the end of the presently authorized production period next Nov. 30 will be about $3,800,000 . . . Tonnage of petroleum products hauled by truck during January was 9.8% greater than December, but 0.6% below January 1944, the A.T.A. reports. . . Maryland's Sen. Radcliffe gives an oil slant to the invasion of Iwo Jima by telling the Senate that as of Feb. 28 the U. S. forces fighting for that little strip of Japan had already been supplied "with enough oil to make a train of tank cars of 10,000 gallons each extending 238 miles long," including "enough gasoline to operate 30,730 automobiles for a full year and enough lubricating oil for one complete change for 466,000 cars."

Atlantic Coast— *Sinclair Man Forecasts Lush Postwar Markets* —By Frank P. S. Glassey

NEW YORK—Service station operators have a tremendous potential postwar market in tires, batteries and automobile accessories, in the opinion of William R. Kelly, who has just been named head of a newly-created tire, battery and accessory department in Sinclair Oil Corp.

Mr. Glassey

Sinclair plans to purchase tires and batteries from Goodyear Tire & Rubber Co., and distribute them to its dealers. The tires will continue to bear the Goodyear name, and in this respect the procedure will differ from that adopted by some other major oil companies, which intend to distribute tires branded with the oil company name.

Mr. Kelly was enthusiastic as he discussed merchandising possibilities in tires and batteries after the war, particularly in reference to service stations.

"When the war is over," he said, "there will be 23,000,000 cars on the street all at least three years old. Those cars will need about 55,000,000 tires in the first year and about 18,000,000 batteries in the first year, plus approximately $250,000,000 worth of accessories.

"Twenty-three million motorists will be released from the pressure of work hours necessary for war production. They will be planning those vacations which have been denied them—the woods, the mountains, the cities, visits to relatives. Three hundred million dollars will be spent the first year just in touring.

"Much of that business will flow to those service stations which are prepared for it. In other words, to stations which have a complete stock of petroleum products, services, tires, batteries and accessories. Sinclair will be prepared to assume the position of a complete supplier of the retailers' needs, and will provide the dealer with a sound and workable program of genuine help."

Mr. Kelly estimates that it will take two years for tire manufacturers to catch up with demand, indicating a firmer retail price structure during that period.

He stressed that the tires and batteries which Sinclair obtains from Goodyear will be offered to dealers, but that Sinclair will not insist that they handle these products. Sinclair will carry the credit for its dealers, and will make shipments against trade acceptances.

Mr. Kelly returned to the United States last year, after 18 months as a fuel officer in the Air Transport Command. He served in the African-Middle East wing of the ATC and later in the India-China wing. The ATC, he said, "is probably the best managed organization I ever saw." After his return to this country, Mr. Kelly was given a medical discharge from the Army.

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Reports from Cairo last week that Rear Admiral A. F. Carter of the Army and Navy Petroleum Board is surveying the petroleum situation in the Middle East revived speculation as to the role that will be assumed by the Arabian-American Oil Co., which has already invested $100,000,000 in Saudi Arabia. Admiral Carter is expected to visit Saudi Arabia, Iran and Iraq.

His trip follows the completion of a special American survey of possible routes for a pipeline to link the Saudi Arabian oil wells with the Mediterranean. The Admiral's visit may conceivably affect

the ultimate decision on whether and where the pipeline will be built.

In that connection, the remarks of James Terry Duce, director and vice president of Arabian American, on the future possibilities of Middle Eastern production are of special interest. Mr. Duce believes that the world may have to turn to that area for oil in the years after the war.

"The reason for the superiority of the American industry," he said, "has not been so much the fertile field in which they have been working, but the energy with which the oil industry has plowed its fields and cultivated its crop. Necessarily, therefore, these fields will wear out before other fields which have not been so completely exploited begin to yield poor results.

"As an example of this contrast in American and foreign production, the situation in the Middle East can be cited. That area, with proven and indicated reserves of approximately 27,000,000,000 barrels, is now producing only 400,000 b/d. Production in the United States, which has a comparable reserve, is in excess of 4,500,000 b/d—more than eleven times the amount being withdrawn from the Middle East.

"With capacity of our fields declining and new discoveries becoming smaller, it is indicated that by 1947 there will be a daily deficit, below the amount needed in the United States, of 563,000 barrels of crude oil. That figure may reach 1,723,000 b/d by 1950. It is logical and necessary that siphoning of oil from the western to the eastern hemisphere should cease, and that the eastern hemisphere should be supplied with Middle Eastern oil."

Mr. Duce predicted that oil will be both more expensive and more difficult to find in the United States in the future.

"The subsidy to stripper wells is eloquent testimony to this very fact," he said. "We have been producing oil too fast for our ultimate good and if another war were to come along and the consumption of oil should be again increased at the same rate as it has over the last 20 years, we would be very hard put to supply our military needs, let alone those of civilians."

Midwest— *Attorney Asks if FPC Intrudes on States Rights in Gas Probe* —By Earl Lamm

CHICAGO — The natural gas industry is faced with a very difficult situation, which in a large measure pivots on the pending Supreme Court decision in the Canadian River Gas Co. case involving jurisdiction of the Federal Power Commission over gas production and gathering operations and the limiting and fixing of earnings of oil and gas producers where the gas thereafter is transported in interstate commerce.

Mr. Lamm

The natural gas industry is not the only one worried about the outcome, for the oil industry is also deeply concerned. As pointed out in this column Dec. 27, if FPC asserts control over natural gas, that control will worm its way through to the oil industry for much natural gas flows from oil wells. That oil companies fear this is evidenced by the hesitancy of at least one large oil company to sell its pop-off gas for transmission in interstate commerce.

In pondering these possibilities, an oil company attorney demands to know if FPC is not invading the responsibilities of state conservation authorities when it investigates gas reserves and measures to prevent production waste in order to recommend legislation. Other questions he asks are:

"Is the Federal Power Commission exercising power over production of natural gas when it asserts it must regulate production in order to exercise its rate-making powers; that it must prescribe the use and amount of gas to be produced and regulate conservation practices in order to exercise its certificate powers; that it must fix the well head price of gas in order to regulate the earnings of a transporter and seller of natural gas?

"If there are 'stimulated misunderstandings', are the gas companies responsible or is the Federal Power Commission responsible?"

Still another pertinent question might have been asked: About the waste of natural gas, who is responsible?

The oil and gas industries have made much progress in conservation but further moves are needed before gas waste is 100% eliminated. It's not difficult to say just why that has not already been done for it's a simple problem in economics. The waste gas so far has not been worth saving; that is, it costs more to save it than it's worth due to lack of a ready market at a profitable price. The fact that gas is wasted proves that the field price is too low—or as above cited, there is fear of Federal control if the gas is transported in interstate commerce.

Another peculiar situation FPC creates for itself concerns the last question injected above. The coal interests oppose the "inferior" use of natural gas under boilers and FPC wants its use for that purpose eliminated, and on the other hand FPC insists upon low utility rates for natural gas, which automatically increases the demand for it in competition with coal. Since gas companies cannot pay more for gas delivered than they get for it, it may be said that FPC is responsible for the waste gas not being gathered. Since pop-off gas in volume in the average oil field is usually of short duration, laying pipe to take it away becomes expensive. Natural gas men are wondering what the Fischer-Tropsch process for making gasoline from natural gas will do for this situation.

A good many industry men feel that the stand taken by former Gov. Jones and the State of Louisiana is both inconsistent and unwise. Political leadership in that state advocates more power to FPC in limiting the "inferior" use of natural gas transported to the Eastern Seaboard area on the basis that stoppage of the gas fuel supply will force the manufacturing plants to move to Louisiana where the "inferior" use of natural gas produced within the state would be permitted as a matter of state rights not subject to FPC control.

It appears to us that as a matter of common sense no manufacturer would put much faith in that plan and move from a coal producing area to one of only natural gas, which he may at any time be prevented from using. It is altogether possible that Sen. Overton of Louisiana, who on last Friday in a surprise move asked the Senate Appropriations Committee for $100,000 for FPC to help finance its natural gas investigation, may in the end get more than he bargains for.

It's long been an open secret that the Southwest has no love for PAW Ickes because of his early threat to control the oil and gas business, and one interpretation that may be placed upon Sen. Overton's action is an intensification of the competition between Mr. Ickes and FPC for future control of the industry; but there certainly appears no necessity for jumping from the frying pan into the fire so quickly.

* * *

We were thrown for a loop last week. A representative from one of Chicago's big hotels came to see us. He was soliciting business. Since the ban on conventions, the pressure has eased up at the reservation desks of all large convention hotels like the Stevens, Palmer House and Morrison "and we can take care of you on short notice" we were informed when we made a checkup. Business at the hotels has settled down and the constant long line-ups at the room windowss have been materially reduced or there are none. The midnight curfew is expected to ease off the room calls still further.

OPA Leaders Cite High 'Profits' in Arguments For Continuing Price Control Through '46

NPN News Bureau

WASHINGTON—Claims that profits of the petroleum refining industry have risen 150 per cent since Pearl Harbor and that profits of other industries have also reached new heights were made this week by James F. Brownlee, OPA Deputy Administrator for Price, as he and OPA Administrator Bowles emphatically denied their agency's price control policy had "unduly squeezed" companies in their profit position.

Testifying before the Senate Banking and Currency Committee in support of extending OPA's price control powers until the end of 1946, Mr. Brownlee used the "150 per cent" profit figure for oil refining in stressing that OPA had not attempted to control profits unfairly. Both Mr. Bowles and Mr. Brownlee showed the committee industrial-profits charts in an attempt to prove that OPA price-control methods and policies have been "generally fair and equitable" and that no permanent harm has been done to industry because of those policies.

Considers Ceilings Fair

(Mr. Brownlee, who desired to place refining profits as high as possible to impress the committee that OPA's policy is not profit control, but price control, neglected to point out that: (1) on products under price control, the per unit price charged by U. S. refiners has not risen at all since Pearl Harbor, but has dropped slightly, according to OPA's oil price branch, and (2) the rise of 150 per cent in refining profits, overall, before taxes, will be erased in good part by renegotiation of war contracts.—Ed. Note.)

"OPA considers maximum prices to be generally fair and equitable," Mr. Brownlee said, "so long as they yield an industry or trade as a whole at least its peacetime profits (before income and excess profits taxes), and, in the case of a multi-product industry, so long as they cover the out-of-pocket costs of industry generally for each particular product or line of products."

Bowles Asks Stronger Law

At another point in his testimony, Mr. Brownlee explained OPA's limited granting of price rises on an individual-firm basis.

"When in our judgment," he said, "a price increase is necessary to aid supply or procurement agencies (WPB, WFA, Army, Navy, PAW, etc.) in carrying out their production programs for war or essential civilian goods—OPA grants price increases beyond those required under the industry earnings and products standards, usually to individual firms whose output otherwise would not be available. If provisions permitting such an increase raise the cost of living, they require the approval of the Economic Stabilization Director."

Mr. Brownlee's testimony followed that of his chief, Mr. Bowles, who asserted that "there is no basis for over-confidence" in the fight against inflation and urged that the present price-control law "be strengthened, not weakened." Three specific changes in the measure which Mr. Bowles proposed the committee adopt were as follows:

(1) Improving enforcement provisions by changing the section of the law which "permits a stay in civil proceedings only after judgment, whereas in criminal cases the stay may be had before trial.

"This means that in the most serious cases of black-market operation, where the criminal sanction is invoked, trial can be delayed for a protracted period while the validity of the regulation is being litigated. Thus justice may be delayed, and perhaps wholly denied by reason of the unavailability of witnesses. We see no sufficient reason for this favored treatment of the person charged with crime, and we believe that his rights are sufficiently protected if he is permitted to seek a stay after trial, as in civil cases."

Sees Black Market Licked

Despite this apparent stumbling-block to OPA black-market litigation, Mr. Bowles told the committee at another point in his testimony that the "fight against the gasoline black market" was one in which his agency claimed almost complete triumph. He pointed out that a year ago "it was estimated that 5% of civilian gasoline supply was leaking as a result of counterfeit or stolen ration coupons. A recent check has shown that it is now less than 1%."

(2) Turning to subsidies, Mr. Bowles told the committee that it is "imperative to the success of the fight against inflation that necessary subsidies be continued, with reasonable leeway for such additional programs as future events may make essential." Bowles said that as OPA Administrator, he does not himself make subsidy payments and "has no concern with the procedure by which the funds for such programs become available." He added, however, that he is "bound to inform Congress that the failure of funds for essential programs of this character would have disastrous consequences for the stabilization program."

(3) He also asserted that "absence of control over prices of real estate, urban

OPA Administrator Chester Bowles (right, above) as he appeared before the Senate Banking and Currency Committee this week to urge extension of OPA's price control powers to the end of 1946. Mr. Bowles said that price control has worked "no great hardship" on private industry, and that both corporation profits and wages were "far above" prewar levels. Mr. Bowles was followed by another witness with the same idea—James F. Brownlee, OPA Deputy Administrator for Price—who told the committee that profits of the petroleum refining industry had risen 150% since Pearl Harbor

WAR OIL NEWS *from* WASHINGTON

HERBERT YOCOM *Bureau Chief*

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and rural, is bringing about a boom in this field reminiscent of the lush twenties, a boom which can have a disastrous effect upon an important segment of our country." Mr. Bowles urged the committee "to give its attention to the problem."

Pressures toward inflation, the OPA administrator asserted, were reflected by the fact that while civilian income has been on the upgrade, supplies of commodities have declined, such as the following: Passenger car tires down 66% from 1941 to 1944; truck tires down 55%; gasoline for civilian uses, down 29%; gasoline for passenger cars, down 41%; and fuel oil for civilians, down 18%.

"It is clear from the foregoing facts," he said, "that supply of most rationed commodities will not catch up with demand for many months—even should V-E Day come before July 1." Although military demands may decline after V-E Day, Mr. Bowles said that "problems of supply will be with us until the end of the Japanese war."

Two members of the committee hearing showed by their remarks that they were not entirely satisfied with the witnesses' attitudes toward inflation or with their methods for holding it in check.

Sen. Taft (R. Ohio) said he favored extension of the Price Control Act but doubted that price control alone could curb inflation.

"It seems to me," he added, "that we've got to stop unnecessary government expenditures and reduce the deficit. In addition, there is the question of whether we can continue wage control, which is just as important as price control, to avoid inflation."

Sen. Millikin (R., Colo.) interrupted Mr. Bowles when the OPA chief declared that price control has worked "no great hardship" on private industry, and that corporation profits, before taxes, had risen from 14.4 billion dollars in 1941 to an estimated 24.8 billion in 1944.

Hotly objecting to the inference he found behind this presentation that the war had been a "good thing" for industry and labor, Sen. Millikin said:

"We're just on a 'drunk' right now, and we'll have to pay for it when the boys come home from war."

Vinson Confirmation to Fill Jesse Jones' Post Awaited

NPN News Bureau

WASHINGTON—Nomination of Judge Fred M. Vinson to be federal loan administrator was sent to the Senate this week by President Roosevelt and prompt Senate confirmation is indicated. Judge Vinson, who is now economic stabilizer, will succeed the ousted Jesse Jones.

As loan administrator Vinson's job will be to administer affairs of all government financing and lending agencies, including such as RFC, DPC (100-octane and pipe line projects), DSC (stripper well and excess transportation subsidies), and Rubber Reserve Corp.

OPA 'Gets Tough,' Warns Gasoline Distributors

Bingo Sheets Must Bear Proper Endorsement

NPN News Bureau

WASHINGTON—OPA this week formally announced a new "get tough" policy regarding improperly endorsed, or unendorsed, sheets of gasoline ration coupons turned in to distributors by dealers. (*See NPN Feb. 21, p. 16*).

Distributors were reminded by OPA that the regulations require:

1. That they accept no "bingo sheets" from dealers in exchange for gasoline unless the dealer's name and address appear on the face of the sheet, together with the date of transfer.

2. That they endorse these sheets with their own names and addresses, when depositing them in their ration bank accounts.

OPA's statement in part, follows:

"OPA feels that some dealers and distributors have been growing increasingly careless in complying with these provisions requiring endorsement of 'bingo sheets.'

"When counterfeit or stolen coupons are found on a coupon sheet, OPA cannot trade these coupons back to the person who put them in circulation unless the sheet is properly endorsed with the name and address of everyone who handled it. Failure to identify these 'bingo sheets' seriously handicaps OPA in its effort to stamp out the black market in counterfeit and stolen coupons.

"To tighten up this situation, a three-point program of administrative and enforcement action will go into effect promptly.

"As one step in its program for tightening controls, OPA field enforcement officers are being directed to undertake injunctive actions against violators of these provisions. Enjoined persons become liable to criminal contempt proceedings in the event of any subsequent violations.

"As another step in the program, OPA has again instructed banks not to accept gummed sheets of coupons acquired by a distributor from a dealer unless the sheets have on them the names and addresses of both the dealer and supplier, and the date of transfer written legibly. This means that if the supplier has already accepted a sheet on which the dealer's name and address, or the date of transfer, are omitted or illegible, the supplier will be put to the trouble of tracing the sheet back to the dealer from whom he received it. Moreover, if he is unable to identify the dealer who surrendered the sheet, he will not receive credit for the coupons on the sheet.

"In cases where the gummed sheets bear coupons received by the depositor from consumers, the depositor must place his name and address on the face of the gummed sheets and the date of deposit, or the bank must refuse to accept the sheet for deposit.

"As the third point in the program, OPA has announced that when these gummed sheets are subsequently found to contain counterfeit or otherwise invalid coupons, and no dealer's name legibly appears on the sheet, the gallonage represented by the invalid coupons will be debited to the account of the supplier. When this happens, the registered storage capacity of the supplier is reduced by the amount of the debit.

"With the program scheduled to get under way promptly, all suppliers should immediately instruct their drivers and collectors to watch out for and refuse to accept sheets not properly and legibly filled out with the name and address of the dealer and the date of surrender. Every supplier also should make sure that gummed sheets deposited in his ration bank account carry his name and address written legibly."

New Gasoline Coupons Good Now, OPA Tells Dealers

NPN News Bureau

WASHINGTON—Dealers may accept new supplemental gasoline ration coupons, B7 and C7, which are now being issued to motorists, OPA announced this week.

Coupons E3 and R3—for non-highway use, are also currently being issued and are acceptable now. Coupons B5, B6, C5, C6, E1, E2, and R1 and R2 continue valid until further notice.

Dealers can identify new coupons as follows: B7 coupons are printed in green, C7 in purplish red (magenta) ink, non-highway E3 coupons are green and the R3's purple.

Lea Moves for House Vote To Continue Oil Inquiry

NPN News Bureau

WASHINGTON — Rep. Lea, of California, has introduced a resolution (H. Res. 155) to authorize continuation of the oil investigation subcommittee of the House Interstate and Foreign Commerce Committee, of which he is chairman.

The resolution has been referred to rules committee, where action is not expected until Rep. Sabath, chairman, returns to Washington in a week or ten days. However, it appears that no objections will be raised and that oil group will be reconstituted promptly.

Showdown Is Near on OPA's Padlock Enforcement Plan

NPN News Bureau

WASHINGTON — Agenda are now being drawn up for the meeting of OPA's gasoline rationing industry advisory panel, to be held here in the next week or 10 days, but it has not been decided whether to list the "station padlocking" idea which OPA has in mind. No policy decision on the plan has been made by OPA Chief Bowles, to whom the matter probably will have to be referred.

Organization of All Tank Truck Operators Urged by Oil Group

Attending a meeting of petroleum transporters from all sections of the country, at A.T.A. headquarters in Washington on Feb. 26, were the following (left to right, rear): Sam Niness, Pennsylvania; Clark Sergeant, California, chairman; Harry Bridgman, A.T.A. acting secretary; Fred Suddarth, Missouri; Dan Hearin, Jr., Louisiana; S. P. Markley, Colorado; J. A. Turner, Illinois; Marian Jones, Colorado; front row, left to right, Ray Atherton, general manager of A.T.A.; Jack Robert, Massachusetts; John V. Lawrence, managing director of A.T.A.; James Barry, Wisconsin; and Frank Baird-Smith, Illinois

WASHINGTON—The first step toward formation of an effective national organization of all tank truck operators —not just petroleum transporters—was taken Feb. 26 when operators from all sections of the country met at American Trucking Assn. headquarters in Washington.

Chairman Clark Sergeant, of California, said the meeting was called to "discuss tank truck operators' problems and organizations, to determine what tank truck operators want done and how they want it done."

Those attending the meeting discussed many alternative forms of organization, and it was the consensus of the group that "some form of conference of tank truck operators be activated within A.T.A. This is to include all tank truck operators, not just petroleum transporters."

As an aftermath of the session, leaders of petroleum transporters in all 48 states are being asked to meet with the carriers in their respective regions. Later—probably this spring—the leaders will meet at some central U. S. city to resume discussions on a nation-wide organization.

Reveals Carbon Black Still Is Limiting Heavy Tire Output

NPN News Bureau

WASHINGTON — "Critical" shortages of carbon black will remain the chief factor limiting output of heavy-tire plants in March and April, Hiland G. Batcheller, WPB chief of operations, disclosed this week.

At the same time, WPB revealed that production of civilian passenger car and motorcycle tires will show a sharp drop during February and March due to the shortage of cotton cord. It is expected that only 5,000,000 of these tires will be made during the first quarter. January production was 1,013,000, or 62,000 less than was produced in October 1944.

Batcheller added that increasing demands of the European front boosted truck tire production 46% in three months despite a severe winter, freight embargoes, and power difficulties. This "tremendous rate of tire production has practically exhausted the inventory of carbon black," he pointed out, "while the inventory of tire cord stocks has dropped down to dangerously low levels.

"The supply of these two critical components must be brought back to full working levels," he continued. "Definite steps are being taken to develop new facilities for making carbon black and tire cord, so we may shoot at new production goals."

Mr. Batcheller said that studies were being completed to determine whether the tire-workers and the industry may temporarily be given a release from Sunday operations until the carbon black supply catches up with tire requirements. He added that this would also give tire manufacturers an opportunity to rehabilitate overworked equipment.

Lauding the industry's tire production record as "a truly remarkable accomplishment," Mr. Batcheller pointed out that 1,770,000 vitally-needed truck and bus tires (A-1 through A-6) had been turned out in January. A total of 1,217,000 such tires was produced in October, 1944.

January output of jeep tires and small truck tires was termed "particularly gratifying." Output of the larger sizes was also up to a new high, he said, though some sizes (9.00 through 14.00 cross-section) were still insufficient to meet stated needs of the armed services.

Other January production figures follow:

(1) Preliminary production figure for airplane tires was 110,200, "which practically met all orders for tires for airplanes and marked an 8% improvement over October, 1944."

(2) Production of 227,000 tractor-implement tires, an improvement of 29% over October production.

Steel Allotments Cut For Second Quarter Due to Arms Demand

NPN News Bureau

WASHINGTON—With second-quarter steel allotments slashed for steel rails and oil country goods, WPB said this week that it would endeavor "so far as possible" to make the cuts in areas where present total production is overtaxing available facilities, transportation, fuel supplies and manpower.

"Production of steel rails and oil country goods will be reduced," WPB asserted, "in order to meet the rapidly rising critical heavy ammunition program." Allotments also were "greatly reduced" for railroads, farm machinery, and commercial exports.

Production Difficulties Cited

Carbon steel allotments to all claimants for the second quarter total 14,822,961 tons, compared with 15,862,377 tons allotted for the first quarter of this year, according to WPB. Total alloy steel allotments are 2,104,603 tons, compared with 2,122,185 tons for the first quarter.

Production difficulties accentuated by unusually cold weather, and shortages of coal, gas and manpower, coupled with rising military demands for steel, were cited as the reasons for cuts in second-quarter allocations.

Canol 'Gas' Costs $42 A Bbl., Moore Says; Early Shutdown Urged

NPN News Bureau

WASHINGTON — Gasoline produced at the famous Canol project amounted to 184,283 bbls. in the last six months of 1944—probably not enough for the needs of refinery and pipeline operation and road maintenance. The gasoline cost about $23 a barrel to manufacture with no allowance for amortization of the project. Including this would boost the cost to $42 a barrel. The summary is the opinion of Sen. Ed. Moore of Oklahoma.

Operating costs of the project were given to Sen. Moore on Feb. 20 by the Army Service Forces, commanded by Lieut. Gen. Brehon Somervell. The Oklahoma senator summed up the information in a letter to the Mead committee on Feb. 24. As a result the committee is expected to make an early demand for an immediate shutdown of Canol.

Summary by Sen. Moore

Sen. Moore's summary of Canol information follows:

Tentative final cost of project as of July 31, 1944, estimated at $101,628,601, not counting cost of highway is broken down as follows: Exploration, $13,399,586; pipeline, $61,269,257; refinery work, $26,959,758.

Total operating costs for last half of 1944: Production, $1,385,846.84; pipeline, $794,076.43; Canol road, $809,856.50; Whitehorse refinery, $1,191,114.66.

Total of 60 wells have been drilled in Norman Wells Field by Army, 53 of which are reported capable of production. Number of wells actually producing was not disclosed.

Salt water intrusion appeared in September, 1944, and by end of December, nine wells which had been completed below water level were making water.

Total gasoline production for six months ending Dec. 31, 1944, was 184,283 bbls. of which only 7,742 bbls. were capable of use as aviation gasoline.

Output 'Insignificant'

"I doubt seriously," wrote Sen. Moore, "that the quantity was sufficient to maintain the operations of the refinery, pipeline and road maintenance. Certainly, this small amount of gasoline produced by the Canol project is insignificant in relation to needs of the Army."

The quantity of gasoline produced compared with operating expenses of project for last six months of 1944 shows that manufacturing cost alone for the gasoline was approximately $23 per bbl. taking into account crude worth of $1.50 per bbl.; allowing a 20-year amortization would place gasoline cost at over $42 per bbl., according to Sen. Moore.

"In view of the complete and indefensible economic failure of this project and its recognized impracticability which has been condemned from the beginning by all experienced oil men, and which later your committee condemned and recommended its abandonment, it would now seem clear, even to the Army, that the project should be abandoned and written off as one of the casualties of war," the senator said, concluding:

"I am submitting these figures to your committee with the hope that it will see fit to go forward with a further investigation into this project with two objectives in view: First, an abandonment of the project and a cessation of the waste incident to its operation; and second, a more penetrating investigation into the motivating forces behind the activities of certain individuals connected with the project."

OPA Studies Ceiling Boost On Steel Drums and Pails

NPN News Bureau

WASHINGTON—OPA is considering a new regulation covering new steel drums, pails and containers that will replace individual "freeze" ceilings with uniform dollars-and-cents maximum prices for some items.

That disclosure was made by OPA officials recently to that agency's new steel drum advisory committee at a meeting in Washington, after committee members asked for price increases because of the recent price step-up for hot-rolled carbon steel sheets. Immediate increases were asked on open-head drums, production of which was resumed in July 1944.

Hearings Set on Two Projects To Bring Appalachians Gas

NPN News Bureau

WASHINGTON—FPC this week announced that it would hold a hearing on March 21, at 10 a.m., in its Washington hearing room on Tennessee Gas & Transmission Co.'s application for a certificate to construct and operate additional facilities, including 95 miles of 16-inch pipeline from the San Salvador field in Texas to connect with its present main line, and to operate under lease from Defense Plant Corp. four additional compressor stations. The facilities, declared "necessary" by WPB, would increase delivery capacity of the Tennessee system by about 60,000,000 cu. ft. daily, the application says, and would permit stepped-up deliveries to Appalachian area war plants.

At the same time, FPC set hearing for March 26, at 10 a.m. in Washington, on United Gas Pipe Line Co.'s application for authorization to construct and operate added facilities including 142 miles of 24-inch pipeline from the Carthage field in Texas to connect with both Tennessee's and United's facilities in Ouachita Parish, La.

United proposes to transport about 170,000,000 cu. ft. of gas per day through the facilities, the order states. Tennessee has a supply of natural gas available in the Carthage field, and United proposes, under terms of agreement with Tennessee, to transport about 100,000,000 cu. ft. daily for that company. The remaining 70,000,000 cu. ft. would be used to augment gas supplies of United in the Monroe field.

Keeton Joins PAW; Uman Named Price Executive

NPN News Bureau

WASHINGTON—A three-way personnel change, affecting both PAW and OPA, was formally announced this week.

W. Page Keeton, who has been price executive of OPA's oil price branch since Sept. 1, 1944, was sworn in as assistant chief counsel of PAW.

Mr. Keeton

Eugene D. Uman, who was recently made associate price executive of the branch, has taken over Mr. Keeton's former OPA position.

And, Carroll W. Johnson, who has been assistant manager, of Pure Oil's wholesale marketing division at Chicago, since August 1943, has been recommended for appointment as head of the refined products section of OPA's oil price branch, a position that Mr. Uman previously held.

Mr. Keeton joined the OPA staff in June 1942 as chief counsel of the oil price branch. From April 1944 to September he was division counsel of the OPA fuel division.

For a year following his graduation from the University of Texas in 1931 with a law degree, he was business manager of the *Texas Law Review*. In 1932 he was appointed to the faculty of the University of Texas Law School. He was granted a leave of absence in 1935 to do graduate work at Harvard University, from which he received a doctorate in jurisprudence the following year. He returned to the faculty of the University of Texas Law School, where he was assistant dean from September 1940 until joining OPA in Washington.

Mr. Uman joined OPA in May 1942 as head of the gasoline price unit. In May 1943 he became head of the refined products section. He was named associate price executive on Feb. 16 of this year. Prior to joining the price agency, Mr. Uman enjoyed nine years experience in the oil industry, in refining transportation and marketing. He came to OPA from Southport Petroleum Co. He is a native of Oklahoma and a graduate of the University of Oklahoma.

Mr. Johnson has spent 21 years in the industry. He was divisional manager for Shell Oil Co. at Honolulu at the time of Pearl Harbor. In October 1942 he became district director of marketing in PAW Dist. 2. In August 1943, he returned to private industry.

O'Mahoney Committee Maps Agenda for Hearing On Nation's 19-Billion Surplus Facilities

NPN News Bureau

WASHINGTON — The special Senate committee on postwar economic policy and planning is now preparing agenda for hearings in the spring to formulate policies regarding disposal of nineteen billion dollars worth of government-owned plants and facilities.

Oil industry leaders, however, whose suggestions will be invited regarding government-owned aviation gasoline plants, synthetic rubber facilities, and pipelines —notably Big Inch and Little Inch— probably will not be called until some time after V-E Day, NPN learned.

Preparations for the co-ordinating of the work of several of the standing and special committees of the Senate are now well under way to carry out this disposal policy responsibility. This co-ordination is being spearheaded by Senator O'Mahoney, chairman of the industrial re-organization subcommittee of the Senate postwar committee mentioned above.

This subcommittee has just been brought to full strength again by the appointment of Sen. Austin, of Vermont, to take the place made vacant by the death of former Republican floor leader, Sen. McNary, of Oregon. Other members are: Sen. Lucas, of Illinois, and Chairman O'Mahoney.

SPB To Make Report

Coincidentally with Senate preparations for studying the problem of disposal of government plants and facilities, the Surplus Property Board, headed by former Sen. Gillette of Iowa, is now preparing its first report to Congress which will present statistical data on these facilities and contain certain recommendations. The SPB is gathering preliminary data for the report with the aid of Defense Plant Corp., and the Department of Justice.

SPB, it is pointed out, has authority under the Surplus Property Act, to dispose of certain types of property, but with respect to plants and facilities costing more than five million dollars in such basic industries as synthetic rubber, aviation gasoline, and pipelines, it is not permitted by the law to authorize final disposition until its program has been on file with Congress for 30 days while Congress is in session.

"What use is to be made of these facilities which constitute a very substantial share of the existing plant capacity and equipment in these most important industries and which are owned by the federal government," said Sen. O'Mahoney, "will go far in determining the nature and shape of our national economy in the postwar world. The productive capacity of these plants is far beyond the consumptive capacity of any market heretofore known, except a war market.

"Whether the plants will be utilized or locked up may depend on whether or not the studies now in the course of preparation will develop a practicable means of using this tremendous industrial capacity for purposes of peace."

This study, said Sen. O'Mahoney, "must be undertaken by Congress without delay because otherwise any report prepared by the SPB in compliance with the law would be in danger of finding Congress and the country unprepared for the tremendous decisions which must be made."

If a way can be found to use in peace the tremendous quantities of aviation gasoline, synthetic rubber and other commodities, he added, "the problem of carrying the national debit will be well on the way to solution. It had long been recognized that mass production alone will not maintain our economy, but that mass consumption is also needed. The problem before these committees will be how to maintain the national income so that the purchasing power of the people to buy the goods and services industry produces may be maintained."

Hearings being prepared by the Senate Postwar Economic Policy and Planning Committee will follow the pattern of those which got under way Feb. 27 by the Senate Small Business Committee on the light metals industry. The light metals hearings probably will last through March. They are under the general direction of Dr. Dewey Anderson, formerly executive secretary of the T. N. E. C. and Dr. Meyer Jacobstein, of the Brookings Institute, who is executive director of the Senate Postwar Economic Policy and Planning Committee.

New Attack Launched On Directive 59

NPN News Bureau

WASHINGTON — On file at the Department of Justice this week and apparently due to be referred to PAW for comments, is the formal complaint of Sterling Stations, Inc., of Fitchburg, Mass., attacking Directive 59 and PAO 5 as "discriminatory, monopolistic and detrimental to the war effort."

The complaint, filed March 2 for Sterling Stations by E. C. Bratt, accuses PAW of "using its powers to make Directive 59 a vehicle for setting up and maintaining monopolies and to restrain small operators from obtaining equality of treatment in the matter of supplies of gasoline and heating oils as well as equal compensation" under Defense Supplies Corp. Compensatory Adjustments Regulation No. 1.

Sterling Stations told Attorney General Biddle that Directive 59 fails to provide relief for other than "certain arbitrarily selected companies as original suppliers," and added that the directive was "largely the product of officials of these original suppliers." Moreover, the Sterling plea continued, "PAW, which is administered by governmental edict, is likewise staffed, especially in its key positions, by personnel who are on loan from the largest of these same original suppliers."

Concluding paragraphs of complaint say:

"We contend that the direct result of the combination of PAW orders and Directive 59 is to deny the right of the small operator to share proportionately with major oil companies and other large operators the available petroleum products, the ultimate result of which is the impoverishment of the small operators while the balance sheets of the large ones show ever greater profits.

"We are convinced that we should be permitted to import petroleum products in accordance with the original Regulation No. 1 of Defense Supplies Corp. and that its Amendment No. 3 and all orders and directives to the contrary, issued by PAW, are discriminatory, monopolistic, and detrimental to the war effort."

Neukom in New OPA Position Directs Local Board Work

NPN News Bureau

WASHINGTON—John Neukom, director of OPA's fuel and automotive rationing division, has been appointed director of local board operations and has been succeeded in the former post by Fred Parker, associate director of the division.

Mr. Neukom originally planned to return to his company, McKinsey, Kearney & Co., of Detroit, about March 15 but at the request of OPA Chief Bowles has accepted the new post.

Mr. Neukom came to OPA in 1942 to set up operations in the original gasoline rationing program. Later that year he was instrumental in establishment of the fuel oil rationing program and acted as branch chief during the first heating season. He went to his company for a short time, returning to OPA in May of 1943 to help Al Whitman, who had been appointed director of fuel rationing. When ill health forced Mr. Whitman to resign, Mr. Neukom took over direction of the fuel rationing division. Several months ago, the fuel rationing division was consolidated with the automotive supplies rationing division, and Mr. Neukom placed at the helm.

Limit on Asphalt Hauls Near

NPN News Bureau

WASHINGTON—An order limiting movement of asphalt by tank car to hauls of 500 miles and under is in the works of ODT and is expected to issue within the next few days, effective either April 15 or May 1.

In recognition of the fact that the order may penalize certain long-haul shippers, particularly Dist. 3 refineries, the expectation is that ODT will be rather liberal in granting exceptions.

Davies Reports Lag In Tank Cars for East

NPN News Bureau

WASHINGTON—Tank car shipments of crude oil and petroleum products into the East Coast region in the week ending Feb. 4 dropped 71,311 b/d below the programmed schedule of 535,000 b/d, Deputy PAW Davies announced this week. (*See p.* 36)

During the week, tank cars hauled an average of 463,689 bbls. of crude oil and petroleum products a day into the Eastern Seaboard, a decrease of 24,137 b/d from the previous week's average of 487,826 b/d.

Explaining the decrease, Davies said:

"The tank cars that were delayed by storms during the latter part of January and the first half of February have not yet returned to the normal regular movement sufficient to maintain consistent loading in the Midwest and Gulf Coast areas. In addition, tank cars were diverted last week from a number of shipping points that were loading military product to new shipping points, owing to a sudden change in military schedules resulting in the temporary loss of loadings.

"As a result, East Coast consumers of fuel oil, kerosine and other products are being supplied at the expense of limited stocks held in eastern bulk tanks.

"This means that consumers must conserve as much of the product they are using as possible, otherwise, we may not be able to get through the heating season without running out of supplies in various local areas, particularly if we encounter further cold weather."

Box Car Kerosine Up

While tank car shipments dropped, box car shipments of kerosine in drums into the New England states continue to climb, reaching an average of 15,959 b/d for the week ending Feb. 24 compared with 15,584 b/d during the previous week. Shipments, however, are below the peak reached during the 1943-44 winter when 16,207 b/d moved by box car during the week ending Feb. 26, 1944. Davies said that the 1943-44 peak had not been reached this year because of the storms.

Dist. 1 stocks of civilian grade gasoline during the week ending Feb. 24 totaled 7,685,000 bbls., an increase of only 36,000 bbls.

Distillate stocks increased 37,000 bbls. to 5,808,000 bbls. as compared with 5,771,000 bbls. during the previous week. The increase was attributed to slightly lowered consumption because of the milder weather.

Kerosine stocks dropped to 187,000 bbls. to 2,482,000 bbls. compared with 2,669,000 bbls. during the previous week.

Part of the decrease in kerosine stocks was attributed to over-consumption by some users, while a large part of the decrease represents movements from the large bulk tanks to dealers storage tanks which had been depleted to unusually low levels during the recent cold spell, PAW said.

Residual stocks dropped 3000 bbls. to 5,154,000 bbls. compared with 5,157,000 bbls. during the previous week.

Big Inch delivered an average of 319,977 b/d for the week ended Feb. 24, compared with 309,468 b/d the previous week while Little Big Inch delivered 228,864 b/d compared with 209,467 b/d for the previous week.

Howard Succeeds Dow as ODT's Liquid Transport Director

NPN News Bureau

WASHINGTON—The successor to Fayette B. Dow, who has resigned as director of ODT's liquid transport department, will be Porter L. Howard, now serving as assistant deputy director, ODT Director Johnson announced this week.

Mr. Dow, who entered government service in 1940 as consultant to Ralph Budd, then transportation commissioner for the Council of National Defense, continued as an adviser on petroleum matters when ODT was created in 1942. Appointed head of the liquid transport department in 1942, he had remained at that post, serving without pay.

Mr. Howard was general traffic manager of Sun Oil Co., Philadelphia, when he was appointed to ODT in 1941. Since then he has served without pay as consultant.

Overton Asks $100,000 for U. S. Gas Resource Study

NPN News Bureau

WASHINGTON — Sen. Overton of Louisiana has asked the Senate Appropriations Committee to vote $100,000 to the Federal Power Commission to help finance its investigation of the nation's natural gas reserves.

He suggested inclusion of that amount in the Independent Offices Appropriations Bill for the fiscal year starting July 1, and said that if Congress voted the sum he would withdraw his resolution authorizing the FPC to inquire into the natural gas situation on an even broader scale than proposed by the commission on its own motion.

"I haven't the slightest idea as to whether the committee will approve my request," Overton told NPN.

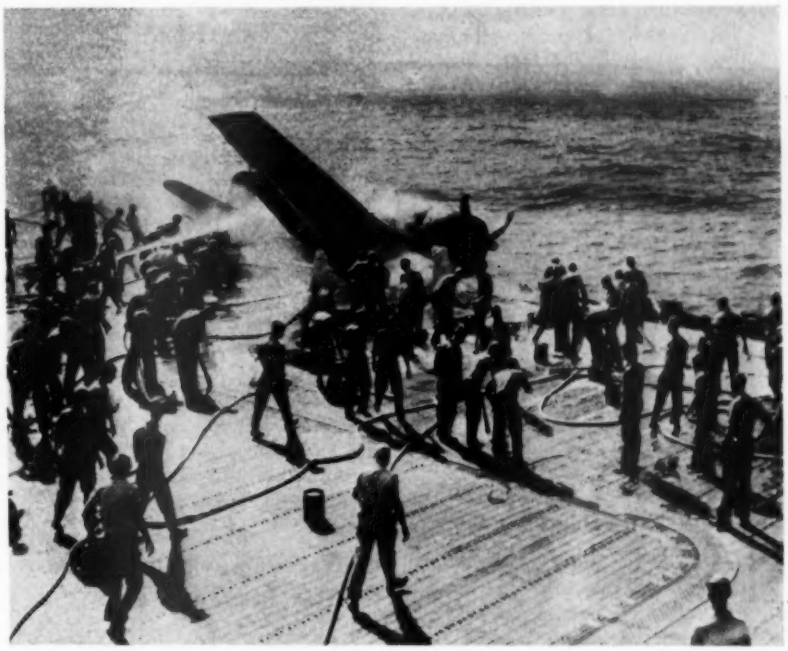
Third Axle Allotments Are Cut for Civilian Vehicles

NPN News Bureau

WASHINGTON—Reduction in 1945 allotments of third axle attachments for civilian vehicles to 3511 units, down 2423 units from last year, because of military requirements, was announced this week by WPB.

Allotments to producers by types of attachments, were reported by WPB's automotive division as follows: gear-driven type 1704 units; chain-driven type, 472 units; trailing type, 1935 units.

Plane Crashes, Catches Fire on Carrier Deck



Official U. S. Navy Photo

The pilot of this flaming Navy plane escaped death in a spectacular landing aboard the U.S.S. Enterprise. The plane teetered over and caught fire when a landing hook caught a wire on a waveoff after a bad approach. Photo shows flames being extinguished by fire fighters using Navy "bean soup" or airfoam. The blanket of foam is made from soy beans and looks like bean soup before air and water mixed with it produce a foamy mass which smothers the fire

Gasoline Demand Up 17% in December

NPN News Bureau

WASHINGTON—Total motor fuel demand in December, including military grades, reached 61,000,000 bbls., or 17% higher than in December, 1943, the Bureau of Mines reported today.

Gasoline yield was 40% in December compared with 40.7% in November. Other yields were reported: Kerosine, 4.5% in December compared with 4.6 in November; distillate, 13.1% compared with 13.5%; residual, 28.4% compared with 28.1%; lubricating oil, 2.5% compared with 2.6%.

Daily crude production in December was 4,687,000 bbls., or 60,000 bbls. below November. Total production in 1944 amounted to 1,677,753,000 bbls., a gain of 11% over 1943. Production dropped in all states east of the Mississippi river in 1944 except in Kentucky, and in Alabama and Florida which have recently become producing states. West of the Mississippi, gains were reported in all states except Kansas, Nebraska, and Wyoming.

Well completions declined to 1,099 in December from 1,154 in November although Texas gained 46 and California 15, the Bureau said. The 1944 total of 13,117 new wells exceeded 1943 by 35% and total initial production gained 56%.

Daily average demand for domestic crude increased 14,700 bbls. in December to 4,764,000 and was 9% above that of December 1943. Stocks of domestic crude were reduced in December by withdrawals of 77,600 b/d. Total demand for domestic crude in 1944 was 23,557,000 bbls. greater than production. Total stocks of crude, domestic and foreign, were 226,969,000 bbls. on Dec. 31, compared with 249,404,000 bbls. on Dec. 31, 1943.

Crude runs to stills of 4,681,000 b/d were 13,000 bbls. higher than in November and almost equaled the record of 4,682,000 b/d set in September. Total runs to stills for year 1944 amounted to 1,665,684,000—a daily average of 4,551,000 bbls. and a gain of about 16% over 1943.

The price index for crude and products was 63.8 in December compared with 63.8 in November and 63.5 in December 1943, according to Bureau of Labor statistics.

Asphalt Roofing Products Under New WPB Limits

NPN News Bureau

WASHINGTON—Asphalt and tarred roofing products have been further standardized to conserve supply of dry felt used in making these products and to increase production of types needed for overseas use, WPB announced this week.

By amendment of Order L-228, WPB prohibits manufacture of two lightweight roofing products formerly permitted (smooth surface roll roofing, type 4, grade B or C; and cap sheet, type 7) and makes specifications for two other types more definite. The effect of today's amendment, WPB said, is to reduce the number of weights of dry felt required in manufacture and increase production of the more serviceable types.

Favors Small Refiners Getting Royalty Oil

NPN News Bureau

WASHINGTON—Sen. O'Mahoney of Wyoming this week introduced a bill in the Senate which would amend the General Leasing Act to direct the Secretary of the Interior to grant preferences in the sale of royalty oil from the public domain to refiners who lack their own sources of crude supply.

The bill proposes to add the following proviso to Section 36 of the act:

"Provided, that inasmuch as the public interest will be served by the sale of royalty oil to smaller refineries not having their own source of supply for oil, the Secretary of the Interior is authorized and directed to grant preferences to such refineries in the sale of oil under the provisions of this section, for processing or use in such refineries and not for resale, and in so doing may sell to such refineries at private sale at not less than the market price any royalty oil accruing or reserved to the United States under leases issued pursuant to this act, as amended."

In a statement, Sen. O'Mahoney said introduction of measure was prompted by his "belief that royalty oil received by the government of the United States from wells drilled upon the public domain should be used wherever possible to sustain the activities of small refineries."

"Under the law as it now stands," he said, "the secretary may direct that the government royalty may be received either in cash or in oil. He has the discretion, as the law now stands, to sell the royalty oil at private sale, but in the past it has been customary to sell it to the highest bidder. This ordinarily means that small refiners who are not also the owners of producing lands find it difficult to get crude oil supplies in competition with the big refiners and the integrated companies.

"The whole philosophy of the leasing act was to encourage small independent enterprise and the new bill would have the effect of giving the small refineries an opportunity to secure their crude from government royalty oil."

Orders Union Maintenance In Gulf Plant in Texas

DALLAS, TEX. — The regional War Labor Board has upheld a special panel which directed Gulf Oil Corp. of Port Arthur to include a maintenance of membership clause in its contract with an A. F. of L. local union in the plant.

Gulf has contended WLB exceeded its authority under the Constitution in ordering maintenance of membership.

War Aid 'Volunteers' To Get Less 'Gas'

NPN News Bureau

WASHINGTON — Only volunteer workers whose work falls in one of five specified categories will be granted supplemental gasoline rations starting on Friday, March 9, OPA announced this week, because "volunteer war-supporting activities" for which extra motor fuel had been allowed were "found to include activities for which the use of extra gasoline from a very limited supply could not be justified."

To limit the field, OPA announced—in Amendment 178 to Ration Order 5C—mileage rationing—that hereafter volunteer workers will be eligible only if their work falls within one of the following categories:

(1) Certain types of activities for social service agencies;

(2) Work regularly performed under the direction of governmental units which contribute to the war effort of the general welfare;

(3) Work regularly performed under the direction of a government or nonprofit organization which either contributes to the general welfare by aiding present or discharged members of the armed forces, or their families, or the families of deceased members, or contributes to the war effort;

(4) Work by a minister who is regularly serving a congregation in meeting the religious needs of the locality that he regularly serves;

(5) Work regularly performed by representatives of government, management, or labor in recruiting or training industrial workers or in maintaining peaceful labor relations.

PAW Lumber Quota Trimmed To Give Military Reserve

NPN News Bureau

WASHINGTON — Second-quarter lumber allocations for PAW will total 13,000,000 board feet, WPB announced this week, pointing out that an additional 1,300,000 bd. ft. will be held as a "contingency reserve" to meet any additional military needs.

Production for the second quarter is expected to be about 12% lower than normal output for that period, WPB said, and a rise in military requirements, starting in March, is anticipated. Because of this situation, it added, establishment of a reserve to meet military demands and offset further decrease in production—"which may be as great as an additional 5%"—became necessary.

Shortage of supply of western pine and hardwoods was also reported.

J. Philip Boyd, director of WPB's lumber and lumber products division said that shortages of manpower, tires, and increased difficulties in obtaining logging and transportation equipment had resulted in "a greater tightness in supply than any previously experienced, with no improvement in sight."

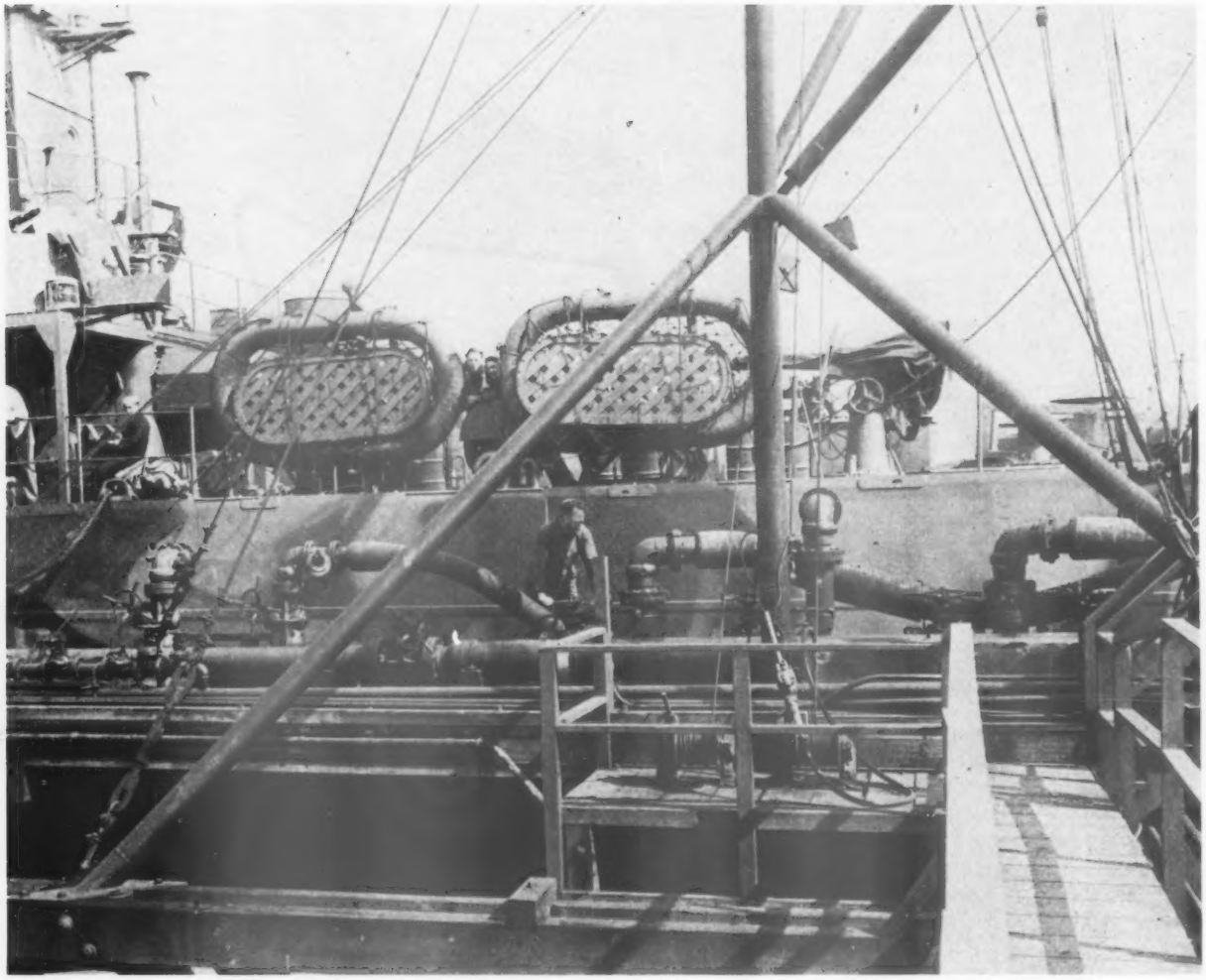
THIS...is the first civilian announcement of the war-born *blended multi-protein foaming agent* for highspeed extinction of gasoline, oil and other serious fires. The U.S. Navy uses this effective multi-protein foam extensively for preparedness—and for quickly extinguishing fires on shipboard and at shore bases. MEARLFOAM-5 yields the live, lasting foam with the tough, elastic water-retaining film. When split-seconds count—you can rely on MEARLFOAM-5 to put fire out fast—keep fire out, *permanently!*

Completely safe and non-corrosive—may be used in standard Mechanical Foam-Forming Equipment

FOAM ON FIRE OUT... Stays OUT!

THE MEARL CORPORATION
153 Waverly Place, New York 14, N.Y.

Navy's West Coast Oil Depot Like a Giant Cave System



Official U. S. Navy Photo

Backing the attack with the vital fuel oil it takes to run the Navy's fighting ships, here an LST is taking on a load of fuel oil before it stands out to sea. This ship is just one of many which pull in at the Los Angeles Harbor for bunkering

NPN News Bureau

LOS ANGELES — Like man-made mammoth caves, a giant system of petroleum vaults of cement and steel, the Fuel Annex of the Naval Supply Depot in San Pedro, Calif. is the focal point for supplying the war machine with millions of gallons of high-octane gasoline, lubricants, and Diesel oils to back the attack in flood-like quantities.

With a capacity of millions of barrels of leased and underground storage, this fuel depot is believed to be one of the largest oil storages of its kind in the world.

The phrase "believed to be" is emphasized by one naval petroleum officer who points out: "If there are any larger ones, we'll find out as soon as we occupy Berlin and Tokyo." Meanwhile, these huge reservoirs of oil are considered "tops."

Celebrating its 150th anniversary as an integral part of the United States Navy this week, the supply corps points to the efficient operation of the Fuel Annex as an outstanding example of the vital service the corps provides in a global war.

Commanding the Naval Supply Depot, San Pedro, of which the Fuel Annex is a part, is Capt. Charles H. Gillilan. Procurement and delivery of vast quantities of all types of provisions for ships afloat and for advance bases in forward areas are the functions of this depot, one of the Navy's key facilities in the staggering logistics of a war fought thousands of miles from home bases.

Like Bank for Oil

Comparing this oil depot with a bank, Commander William P. Coltman, USNR, officer-in-charge of the Fuel Annex, says that while his customers are huge ships and machines, he also records daily deposits and withdrawals. The commander's medium of exchange is oil rather than money.

Deposits are brought to his bank in rolling tank cars, filled with petroleum liquids. Withdrawals are made by tankers and other ships which pull in at the Los Angeles harbor for loading and bunkering before hurling their combined armed might back to the far-flung battlefronts.

Approximately 300 tank cars unload their cargo daily at this fuel depot. The cargo includes many types of petroleum products, ranging from vital lubricating oils to grease the wheels of victory, to the super-gasoline of World War II—100-octane plus, the plus standing for a far superior type of aviation gasoline than was possessed by the Allies before this war, and one which is believed better than any now used by the enemy.

A high percentage of all petroleum products leaving the West Coast for overseas pass through this underground depot. While these products are now bought by the Navy from private oil companies, another important source is being tapped for even greater quantities. This is the famed Elk Hills Reserve.

Elk Hills in Picture

Elk Hills, a huge Naval crude oil reserve located about 25 miles west of California's Bakersfield, has long been Uncle Sam's "ace in the hole," as far as crude is concerned, and right now, crude from newly drilled wells in this area is being refined, with the finished products high-balled over the rails in tank cars,

(*Continued on p.* 63)

The Trend of Post War Pumps has already been established by BOWSER

SERV-A-CAR

THE SUPER GASOLINE MERCHANDISER FOR TOMORROW'S SUPER MERCHANDISING STATION

. . . Yes, we're looking ahead, too! Just as it has been doing for sixty years, Bowser has continued to cooperate closely with the petroleum industry . . . studying and interpreting future trends . . . designing equipment to improve the merchandising of gasoline. With the coming of tomorrow's new type merchandising stations . . . there also comes a need for a new type, low style dispensing pump — a pump with beauty, visibility, convenience and stamina in a new degree. That pump has already been designed . . . it's the Bowser Serv-a-car . . . another of the outstanding "firsts" by Bowser.

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Not only has Bowser's war production earned the Army-Navy E . . . Bowser equipment has helped earn it for scores of other companies.

. . . AND AS QUICKLY

as conditions permit, Bowser will be back in the production of the modern, pace-setting models which it formerly made. These trying war years which demand the utmost from present equipment, have caused many dealers to say . . . I'm sure glad I bought Bowser, they've got what it takes!"

BOWSER ESTABLISHED 1885

THE WORLD'S OLDEST GASOLINE PUMP MANUFACTURER!

Recapping Today's Giant— But What of Tomorrow?

By Herb Taylor,
NPN Staff Writer

CLEVELAND—Investigation of the future for the tire recapping business for the oil industry at this time definitely indicates that it will become as much a part of postwar marketing operations as will the sale of tires, batteries and other accessories.

Any doubt as to oil's role in the future tire business was dispelled with the announcement by American Oil that they will market tires under their own brand name. At least one major oil company, Socony-Vacuum, has awarded a contract to a rubber company (Kelly-Springfield) to manufacture their brand of tires after the war. Other major oil companies are known to be ready to follow suit.

The plans of the major oil companies include the recapping business, not as a "necessary evil", but as a money-making, business-getting part of their operations. The management of these companies knows the answers, too.

They are not discouraged by the predictions by some rubber companies that when new tires become plentiful recapping will pass out. Perhaps they see these same rubber companies frantically building up their own tire recapping plants.

Many Majors Now in Recapping

Not many of the major oil companies have their own plants as yet. Kentucky Standard pioneered with a plant in Louisville for passenger tires, and followed it with another in Birmingham for truck tires, and has definitely made it a part of its business for now and the future.

Standard of Ohio has three plants—in Cleveland, Toledo and Cincinnati, and also about 35 contract plants, all running 24 hours a day, seven days a week.

Pure Oil has its own plant with big postwar plans. Union Oil, Mid-Continent, and Texaco are carrying on aggressive recapping programs, with a tie-up with Firestone. Gulf, Shell and other companies are carrying on their programs through their rubber company connections.

This is the second of two articles on the postwar prospects of tire recapping

Here is a composite picture of the thinking of a number of sales executives in major oil companies on the subject:

"There will be recapping in volume for four years after the war. It is true that some surveys indicate that a very small percentage of those who recapped during the war expect to do it after the war. Even if that is true, there will still be business for reputable and aggressive merchandisers. Many of these people surveyed are making good money now and have delusions of high wages from now on out. The picture may be different when postwar production catches up with demand.

"It is quite possible that there will come periods when tires will become cheap—the $6.66 grades might even return—and recapping not be economical. Then the shops will simply be closed, or run on a limited basis, like any other manufacturing plant.

"The biggest headache for reputable major oil companies has been in the farming out of the tire recapping business. They have paid through the nose for mistakes and incompetence of outside recappers. The only solution for this is for the control of the recapping plant.

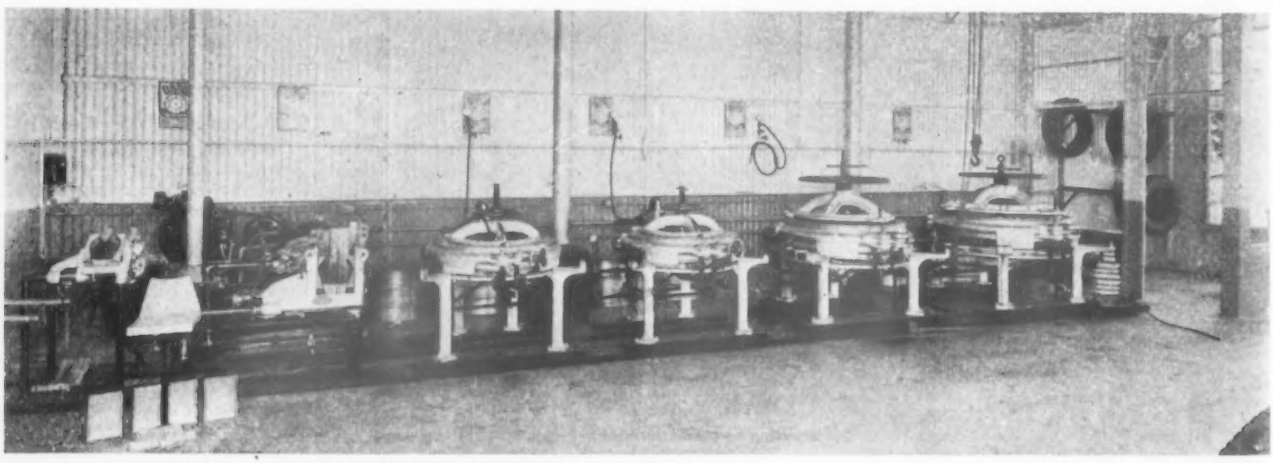
"In the case of our distributors, we see an over-abundance of gasoline, the keenest competition in history and the necessity for aggressive merchandising, including recapping."

There seems to be a general impression that the large rubber companies are against recapping, except for themselves. This may be due to the fact that these large companies have large, enthusiastic and able recapping divisions on one hand, and a sales organization interested in the sale of new tires on the other.

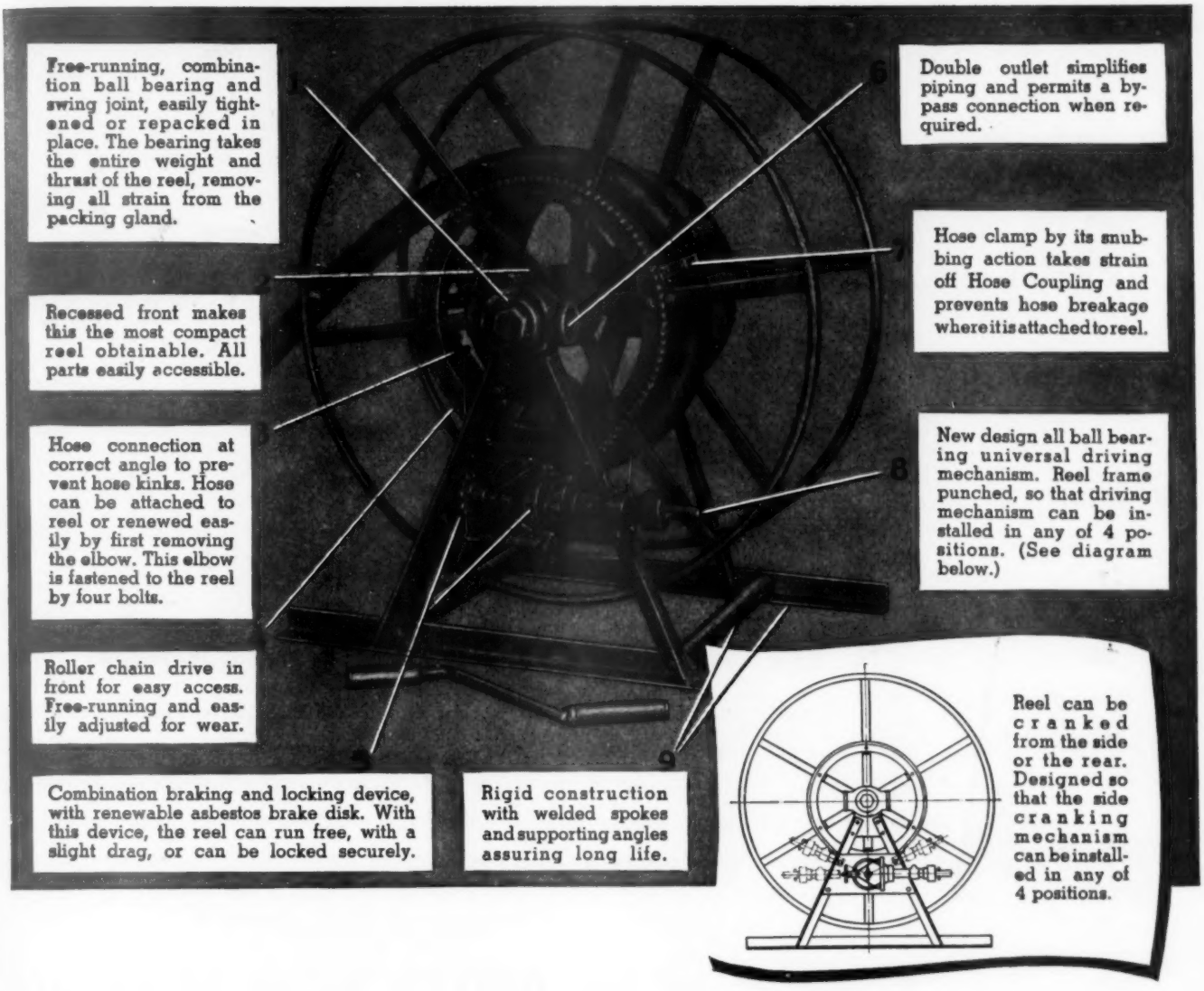
Survey Results Revealed

In the mile-long rambling offices of the major tire companies one can find many impressive reasons why the future is bright. And you can find reasons why it is black, too. One company estimates a postwar business of seven million recaps, and has an impressive "confidential" survey to prove it. Another of the big majors, who leans more towards a brighter future, also has a super-confidential survey (this writer has a copy picked up at a major oil company office) which indicates that 35% of 32,000 motorists surveyed will recap postwar; 14% are undecided, and 51% will not recap.

On the basis of this survey, postwar recapping business will be greater than



A complete installation of recapping molds in a California plant. All size tires except heaviest earthmover and tractor equipment are handled


1 Free-running, combination ball bearing and swing joint, easily tightened or repacked in place. The bearing takes the entire weight and thrust of the reel, removing all strain from the packing gland.
2 Recessed front makes this the most compact reel obtainable. All parts easily accessible.
3 Hose connection at correct angle to prevent hose kinks. Hose can be attached to reel or renewed easily by first removing the elbow. This elbow is fastened to the reel by four bolts.
4 Roller chain drive in front for easy access. Free-running and easily adjusted for wear.
5 Combination braking and locking device, with renewable asbestos brake disk. With this device, the reel can run free, with a slight drag, or can be locked securely.
6 Double outlet simplifies piping and permits a by-pass connection when required.
7 Hose clamp by its snubbing action takes strain off Hose Coupling and prevents hose breakage where it is attached to reel.
8 New design all ball bearing universal driving mechanism. Reel frame punched, so that driving mechanism can be installed in any of 4 positions. (See diagram below.)
9 Rigid construction with welded spokes and supporting angles assuring long life.
Reel can be cranked from the side or the rear. Designed so that the side cranking mechanism can be installed in any of 4 positions.

The New Hose Reel You Have Been Looking For

COMPACT, RUGGED, LIGHT IN WEIGHT, BALL BEARING CONSTRUCTION THROUGHOUT

The new Philadelphia Valve Co. reel is the finest reel built. It is compact, rugged, and light in weight. All parts are of steel, malleable iron, or bronze; no cast iron is used. It is ball bearing throughout with hardened and ground races. (6 ball bearings are used.) It will never wear out.

The reel can be changed from top winding to bottom winding by reversing the hose connection and rotating the drum. All working parts and hose connections are in front and easily accessible. It is light in weight, a reel that holds 100 feet of 1½" hose, only weighs 93 pounds.

We can furnish hose reels in any size or shape. They can be furnished for installation either in bucket box at rear of truck or in underslung box on side of truck. Give inside dimensions of box when writing for information. Special reels can also be furnished for Airfield Refueling Pits and Ship Docks.

Delivery can generally be made in a few days after receipt of order. For sizes, prices, and dimensions, write for Catalogue No. 165.

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ARAMINGO AVENUE AND ONTARIO STREET, PHILADELPHIA 34, PA.

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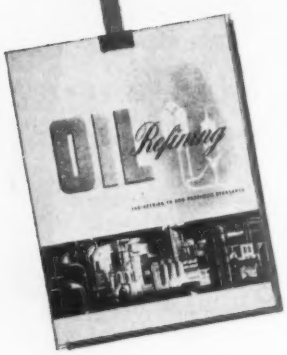
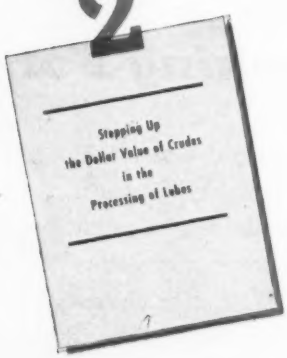


OIL REFINING... engineering to new precision standards

Coming at a time when every refining executive and technical man is re-evaluating the post-war future of the hydrocarbon . . . this booklet provides a refreshing summary of the over-all picture. It discusses in detail the processes which are their own definition of the economics of modern refining. It analyzes the role of the engineer-contractor in the utilization of these facilities for both domestic and foreign markets in the new era.

2



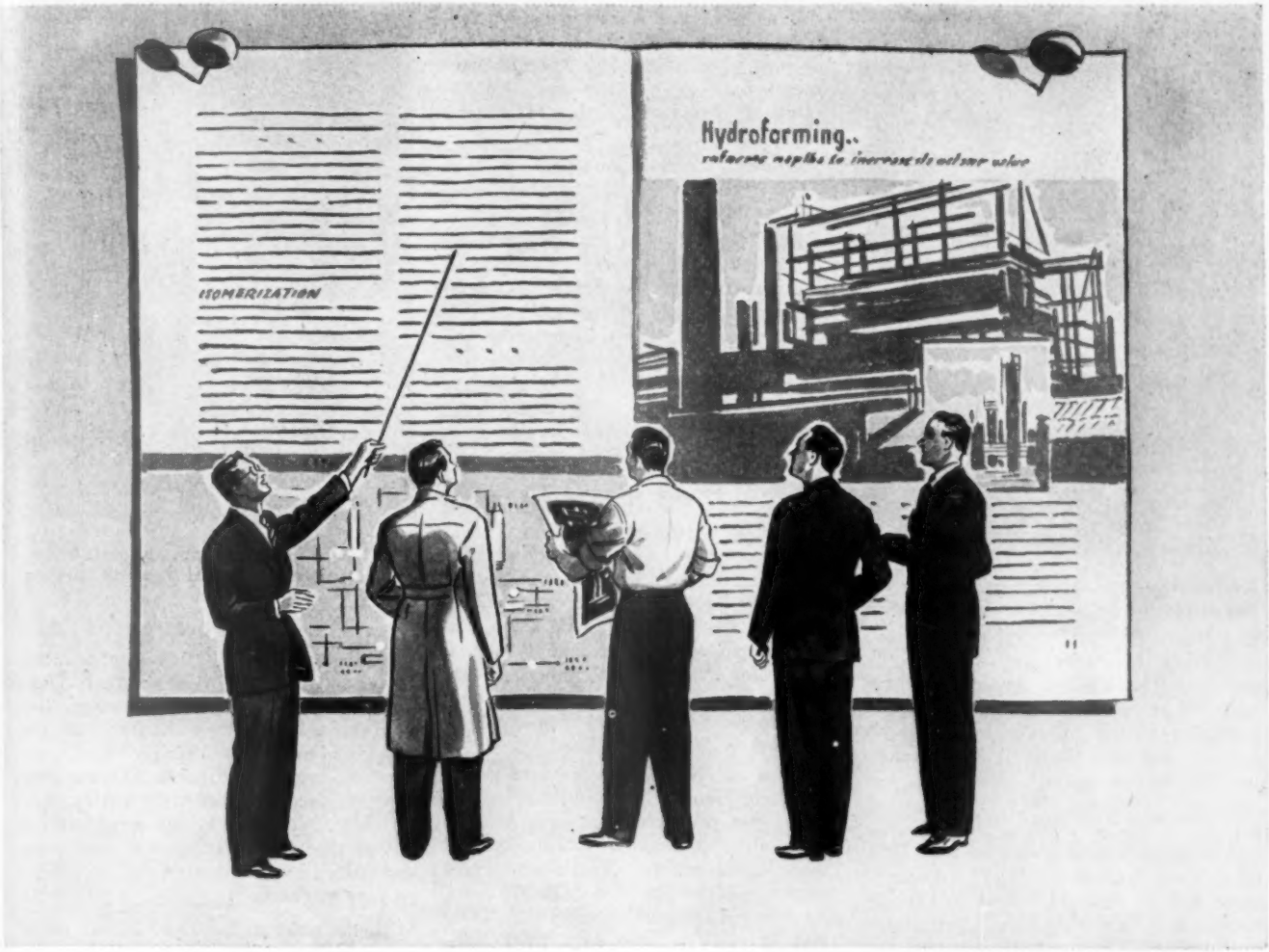
STEPPING UP THE DOLLAR VALUE OF CRUDES in the processing of Lubes

Analyzing the lubricating oil refiner's current position and future . . . this 26-page report discusses the changing significance of the term, "select crude." It discusses the impact of modern "Tower" propane deasphalting on the traditional economics of lube processing. And further, this report summarizes in detail all related modern processes which establish the prime factors in economical production.

3

KELLOGGRAM...the Fluid Catalytic-Cracking Process—How it Operates

Undoubtedly, the *Fluid* Catalytic-Cracking Process is the outstanding factor today in the oil industry's vital contribution to the war effort. As such, it proves of major interest to refining company executives and engineers alike. Here then, in a special edition of *The Kelloggram,* is the complete, factual story of the process... by the men who have seen it through to commercial operation from its initial laboratory pilot-plant stages. The revolutionary use of the long known principle of *differential heads* is fully demonstrated. And the table of typical yields included—for feed stocks ranging from light gas oils to reduced crude—provides a thought-provoking evaluation of the process' post-war future.



COPIES of this current "required reading" have been mailed, of course, to every executive and technical man on The M. W. Kellogg Company's list. But if for any reason, you have not as yet received your copies, please write us for same and we will forward them to you immediately.

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Hynes Pitner . . . Right now it's time for the petroleum jobber to make a decision about recapping

prewar. The greatest amount of business will be in the West, followed by the Southeast, closely followed by the South Central, with the North Central producing the smallest amount of business.

Smaller Tire Firms Approve

This same survey indicates that 70% of wartime volume on truck tire recapping will be enjoyed. This survey indicates that only 9% of truck tire recaps are unsatisfactory, and would seem to refute the claim that truck tire recaps are unsatisfactory.

So far as the smaller tire companies are concerned, without any if-and-ands, those contacted are for it. One company, Pharis Tire & Rubber Co., set up its own plant as a "guinea pig". It started by doing recapping work for its own employes, then extended the service to outside sources as a service. The company spent much money, time and effort in getting a completely unbiased picture of the business.

Following is that company's attitude as expressed by its vice president and sales manager, Hynes Pitner:

"Right now it's time for the petroleum jobber and dealer to make a decision about recapping. He should make up his mind this moment that either he is going to get part of this golden flow and render the complete service he owes his customers, or he's deliberately going to throw away 25% of his potential business today and even more in the next few years.

Why Present Is Ideal Time

"Good recapping is here to stay for a long, long time—make no mistake about it. Its striking success on the Pacific Coast will be duplicated in many other sections. During 1944 there were 22,000,000 passenger tires and 6,500,000 truck fires recapped. Predictions are that between 30 and 40 million passenger tires and 8,000,000 truck tires will be recapped in 1945. . . .

"Here at Pharis we feel we know something about the problems of the outlets for petroleum products because our civilian production is concentrated among these outlets. That's why I say without qualification that YOU'RE NOT IN THE TIRE BUSINESS IF YOU DON'T GIVE RECAP SERVICE. Whether you do your own recapping or make a deal with a good recapper is up to you. The point is, if you're really in the tire business, you must have recapping facilities.

"Why is the present moment the ideal time to go to town on recapping and repairing? Simply because the tire business is a seasonable affair. During the past few months when the mercury was flirting with zero, the recappers have been hungry for business because they were experiencing their seasonal nosedive. OPA isn't fooling when it says 'Recap now!' OPA knows that the scramble for recapping this summer will resemble the carryings-on in a madhouse.

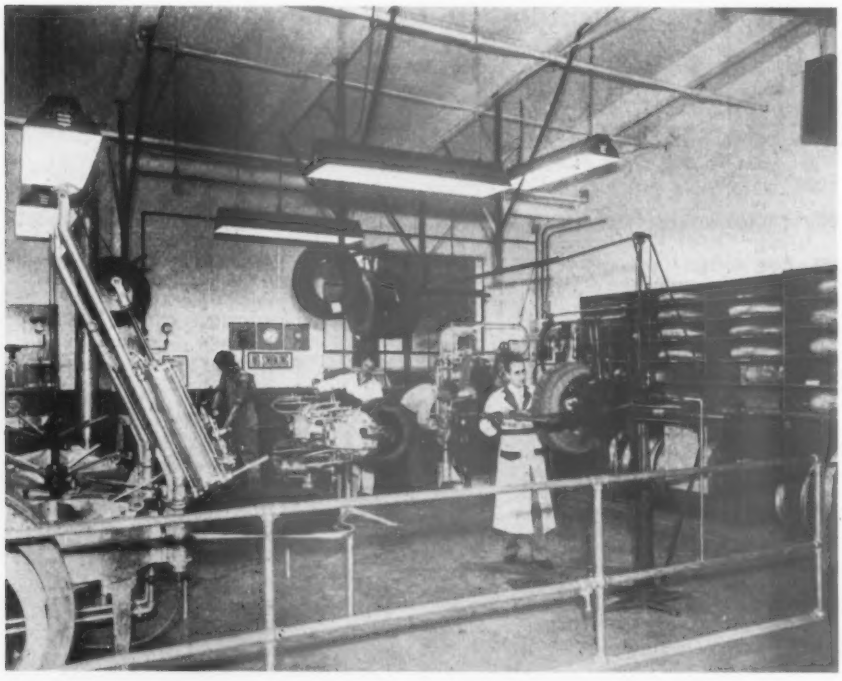
This job of applying camelback is being duplicated in thousands of recapping plants

"Let's look at the dollars and cents of recapping. The ceiling price on a 600-16:4, using Grade A camelback, for the recapping only (where the customer furnishes the tire) is $7, as against a new tire price of $16.05, plus $1.15 excise tax. If you have a recapping source of supply your cost should be around $4.90, which would leave you a profit of $2.10, or 30%. Add to this the customary 50c for mounting, plus a frequent profit on repairs—sections, reinforcements, spots—and the recap of one tire alone is a sizeable addition to the right side of the ledger. Since most recap jobs are for entire sets of four tires, you can see that the return fully justifies the effort.

"Naturally when you get into the larger tire sizes, they are an even more fertile source of added revenue. The recap ceiling price, for instance, on an 8.25 x 20:10 truck tire is $18.65, of which your 30% profit would be $5.88. Good recapping definitely will be a part of the future truck tire picture. Since truck tires have especially good carcasses, mileages of 100,000 to 150,000 are looked forward to as a plain matter of fact, thanks to recapping.

"The number of success stories in the recapping field would fill pages in NPN. The chances are the guy right down the street from you is one of them and is having a quiet laugh up his sleeve at your reluctance to make your operation self-sufficient, a really one-stop service affair for your customers.

"A good recapper will guarantee his



A section of a recapping plant in Cedar Rapids, Ia.

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We're pretty busy serving Uncle Sam now. But keep your eye on Continental! And on Continental's trademark, too. The Triple-C stands for *one* company with *one* policy—to give you only the very best in quality and service.

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Continental has a full line of fiber drums for shipping dry products, resins, rosins, asphalt, grease and other semi-liquids. Sizes range in capacity from 10 to 65 gals.; "Stapak" drums from 2 to 32 gals.; "Fiberpak" drums from ¾ gal. to 67 gals.; Leverpak" drums from 24 to 75 gal. cap. The "Leverpak" drum is illustrated above.

product. At Pharis we have discovered that guaranteeing the job is the soundest basis for success. Curiously enough, it appears that a reputation for quality is more necessary for the recapper than the vendor of new tires. Whereas the customer will buy almost any advertised tire without question, he's much more interested in the qualifications his recapper has for doing the job intended.

"A good recapper will put 'loaners' on a customer's car while tires are being recapped so the recapping process does not have to be hurried. One of the most important factors in recapping is complete and thorough drying, which requires a minimum of 24 hours. This can be accomplished when the motorist, using 'loaners' doesn't have to crowd you.

"Of course, it's only fair to say that the quality of the camelback plays a big part in determining the success of the recapping. Much 'F' grade camelback, all reclaimed rubber, was formerly used, followed by 'C' grade, which is 40% reclaimed. Until recently 'A' grade was used, but Army requirements have now brought about a cutback to 'C' grade. After the war it is a certainty that all quality shops will have a high-grade camelback to work with. We have had numerous instances of 'A' grade camelback giving more than 25,000 miles of service.

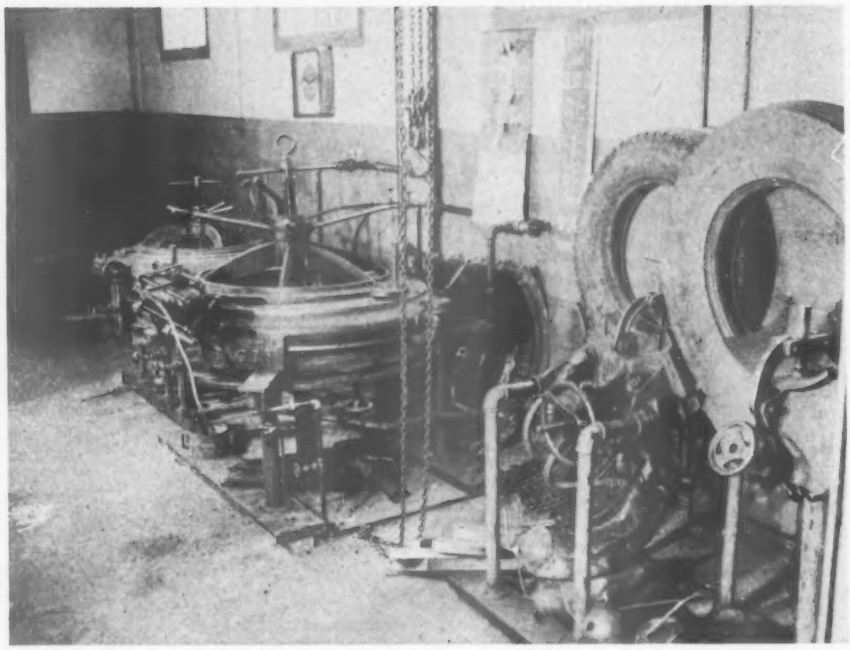
Shall You Have Your Own Plant?

"Now comes the really big decision you must make regarding recapping. Shall you establish your own recapping plant or make a recap connection? I have no desire to take sides in the matter. As with most controversial matters, there's plenty to be said both for and against each method of operation. I do know that tire dealers are making money both ways. They are serving their customers well in both ways.

"If you don't want the headaches of establishing your own facilities, make a good connection. How can you be sure what type is best for you? Easy—depend on your tire supplier. He's best fitted to make recommendations to establish the connection. If you set up a good source of recapping service, you won't be able to control its speed and reliability as you would if you had your own facilities. You'd save your customers at least one day by doing the work yourself. You'll have to pass up the extra gross profit from the actual recapping operation, which is estimated at $1.65 on a 600 x 16 tire. You may miss the prestige and feeling of achievement which comes from expanding your own physical operations.

"Recapping is not necessarily a complicated business. Your supplier of camelback will give you all the necessary know-how on operating efficiently and economically. You can send your personnel to our factory, or to the factories of any of the established tire companies, and they will be taught modern recapping. The Rubber Manufacturers' Assn. has done a splendid job in assembling its manual of 'Recapping—Tire and Tube Repairing.'

This mold is for recapping tractor tires



A section of the Pharis Tire recapping shop, showing curing molds

Chiefly a Production Job

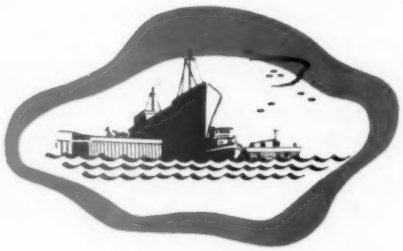
"But get this point: Recapping is a production job. If you run a recapping plant, you are a manufacturer running a factory, even though it is only a small factory. In a small way, you'll have all the difficulties of the manufacturing business. You'll find your operation a lot different, much more complicated, than when you were just a merchant. Make sure you are constituted to take on the additional responsibility. Above all, make sure you have a man who can give the recap plant the necessary supervision. You can't, you know, be everywhere at once.

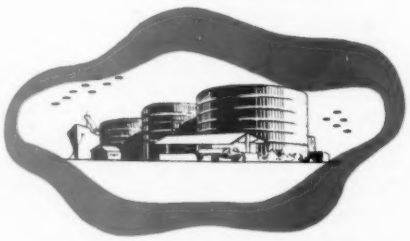
"I said (assuming, of course, you had the resources) that the recap boom was certain to last long enough for you to make out okay on your financial investment in setting up your own recap facilities. But a few words on what that financial investment is shouldn't be out of order. To get started with practically minimum requirements will involve an outlay of approximately $5025—this is rough of course, broken down as follows:

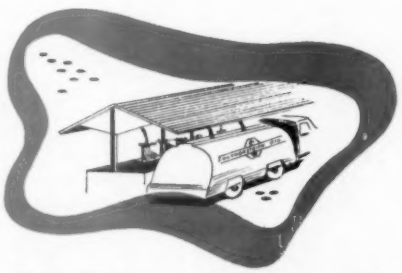
	Approximate Cost
1 Precision Buffing Machine	$ 390
1 Passenger Tire Mold (for popular sizes) including matrix, steam chamber and stand	885
1 Truck Tire Mold (complete)	1500
1 Sectional Repair Mold (complete)	550
1 2½ to 3 h.p. Boiler	350
Buffer, spotter, curing bags, tube repair equipment and miscellaneous equipment	600
Installation cost, including lights	600
Camelback, tread and cushion gum, cement and other supplies	150

"As to requirements in personnel, if you operate two molds eight hours a day, you'll need two men. Additional molds and longer hours, of course, will mean more manpower. Then, too, perhaps your present space may not lend itself to recap installation. In that case, you'll have the extra rent for a location that's at least 20 x 30 feet, including drying room.

"So there you are. As the guy at the carnival says: "You bets your money and takes your choice." But there is no doubt that recapping is a good bet. If you don't make that bet, you'll wind up a loser in the tire business. Whether you make a good recap connection or set up your own facilities this much is certain: If you have real vision, now is 'the time for that decision.'"







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March Crude Demand Figured At 4,742,000 B/D

NPN News Bureau

WASHINGTON—A total of 4,742,000 b/d of domestic crude will be required during March to meet market demand, up 17,000 b/d from February, and up 181,000 b/d from March, 1944, the Bureau of Mines estimated this week.

At the same time, it announced that data available for February indicate that demand may be a little higher than the forecast of 4,725,000 b/d for that month. Preliminary figures for January indicate an approximate demand of 4,720,000 b/d.

Wilson Predicts 25% Gasoline Boost at V-E Day; Ration Then Unwise, He Tells Economic Club

NPN News Bureau

CHICAGO — Replying to queries from his audience of about 500 attending an Economic Club dinner at the Stevens Hotel on March 2, Dr. Robert E. Wilson, board chairman of Standard of Indiana, the principal speaker, said it would take some 100 octane plants about 24 hours to convert to the manufacture of motor fuel for civilian use when the time came. Other plants, he said, probably never would be available for that use because, in their emergency construction, expense had been disregarded.

Touching on several controversial subjects in his address and in the questions that followed, Dr. Wilson said that the oil industry had stepped up its output about a million barrels a day compared with 1942, but that the military had taken all of that and 700,000 b/d more. Consumption of aviation gasoline is now about 100 times that at the peak of World War I, and motor gasoline is about 19 times as great, he said.

He predicted that after the collapse of Germany "as much as 25% more motor gasoline" may be available for civilian consumption in this country after providing the military with supplies to "hurl everything but the kitchen sink" in Japan's direction. Transport limitations will have their effect on this, he said. So will the leftover products from 100 octane after the "cream" has been removed from super-fuel as provided in plans already made.

A questioner asked about additional Government controls after the war.

"I hope it will not be that bad," Dr. Wilson replied. "Mr. Ickes has promised less controls, and I believe there will be a substantial reduction, but I doubt if we will get back to prewar freedom without battling for it."

Commenting on the black market, he told an inquirer that if he referred to the black market in gasoline, it could not be more than 2% or 3% as there was only about that difference between consumption and authorization figures. However, he thought the black market, interpreted in terms of counterfeit coupons, was cutting into regular consumption about 10%.

In answer to other questions, he said that the International Petroleum Agreement now being developed in Washington could be a factor in preventing another world war, although the question was a little over his head. "But conferences can help," he added, "especially since America and Great Britain control 70% of the world's oil production."

Asked if natural gas waste had been eliminated in the production of oil, he said: "If you mean blowing of gas in connection with production of small amounts of oil, the answer is yes; but there are situations where there are no means of recycling the gas and repressuring the underground oil reservoir and no market for the gas. In circumstances like that," he said, "it is not possible to produce the large amounts of oil we do without some waste."

Small by Oil Standards

"Will development of chemical by-products provide a large market post-war?" another man asked.

"Judged by chemical industry standards," the speaker answered, "it will be large, but compared to oil industry standards, it will be small. Synthetic rubber," he continued, "represents only a fraction of 1% of oil production or demand." He thought oil might have a profound effect on chemistry, but not the volume of profit from oil production.

As for an export tariff on oil, he believed there is very little likelihood of that.

In his address preceding the questions, Dr. Wilson said there were some who contended that it would be unwise to relax restrictions on rationing promptly after the end of the European war because of the critical situation in tires and spare parts, but he thought that after the troubles experienced in rationing gasoline when it was really short, it would not be practicable to continue rationing when gasoline became plentiful. Prompt relaxation would be desirable along with a frank explana-

Arnold's Patent Bill Plea Hits 'Fencers'

NPN News Bureau

WASHINGTON — Federal Judge Thurman Arnold, former head of the Justice Department's antitrust division, charged today that the practice of large American corporations of acquiring and holding a large number of patents had permitted them to "corner the market" on a given commodity and to "fence off" a large part of the field of scientific and technical knowledge.

Testifying before Chairman Walter's subcommittee of the House Judiciary Committee, in favor of the Voorhis Patents Bill (H. R. 97) Arnold said that an Indiana Standard official once told the attorney general that when America entered the war "we were 40 years behind the Germans."

Asks About Inventor

"The question then arose as to what had happened to our technical schools," Judge Arnold continued, "and of course the answer was that this entire field of technical knowledge had been fenced off."

There's no harm in two or three people forming a corporation or merger until the time when they "control the market for a commodity," the witness asserted. "At that point, the corporation should lose its patent franchise. And that, as I understand it, is what this bill does."

Chairman Walter interrupted Arnold to ask whether the Voorhis bill would result in punishment for an "innocent inventor" who sells the rights to a corporation and "is not allowed to see the corporation's books."

"I see no reason why the law should go that far," said Arnold, adding that "at any rate, in most cases the inventor does have the privilege of examining the corporation's books.

"One of the most important sections of the bill," he added, "is the section which gives the federal government the right to intervene in patent suits. A patent suit is supposedly between 'A' and 'B' but it is actually between the holder of patents and the rest of the field."

Rep. Kefauver (D., Tenn.) said he thought that if the government intervened in such suits, its "great weight" would influence the court's decisions. But Arnold sought to quell Kefauver's fears with the statement that the government would intervene "not on one side or the other, but partly against both sides" in patent litigation.

No date was set for continuation of hearings, but Chairman Walter said that "several more witnesses" will be heard before the committee votes on the bill.

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London, England

tion to the people as to when they might expect tires, spare parts and cars, he said, leaving it to them to do the amount of conserving of their cars necessary to make them last.

He said the amount of fuel oils released after Germany's collapse will be less proportionately than gasoline because of the great need the Navy will have for bunker fuel on long trips across the Pacific. He predicted a slump in gasoline demand during the first postwar year owing to shortage of six or seven million cars compared with previous levels. Demand for other products will hold up or increase, he said.

Commenting upon statements from various sources about crude oil reserves, he said the total had declined only because of the rapid increase in current consumption, but at the end of 1944, a new high had been reached of 20,450,000,000 bbls. Technology, he said, has played a large part in keeping up the supply of petroleum. Once 70 to 80% of the oil was left in the ground, but now the amount is usually not more than 30 to 40%.

However, the day of burning fuel oil in direct price competition with coal is about over, he said, as higher octane gasolines will lead to development of more efficient engines and cut down the amount of fuel they will need. Presumably, this reference was to railroad use of heavy fuel.

Despite all improvements in methods of exploration and production, the speaker acknowledged that returns on the effort expended are diminishing, and without fear of actual exhaustion of oil supplies, he said coal and other sources should be investigated.

Veterans of Pure Oil Mark 25th Year For Heath Refinery

Special to NPN

NEWARK, O.—The Heath Refining division of Pure Oil Co., celebrated its 25th anniversary here March 1 with a program highlighted by a talk by Commander Roy H. Callahan, U.S.N.R.

The veteran naval aviator, who recently returned from duty as operations officer of an airplane carrier task force, told the meeting of 400 refinery employes and their wives that the continuing supply of flying fuels was due to consistent, co-ordinated efforts.

"Right here at Heath Refinery," he said, "you are turning out aviation gasoline components and it may be that your products powered the planes flown from the carriers on which I served. I wouldn't be surprised either if some local boys were on that group of carriers, for our personnel came from just about everywhere."

After the anniversary dinner, J. Porter Langfitt of Chicago, assistant to the vice-president in charge of refining, presented a 25-year service pin to E. E. McPherson, Heath superintendent.

Other speakers were R. D. McClaran, former Heath superintendent who is now in charge of Pure Oil marketing operations in the Indianapolis zone area; C. Ray Fenner of Columbus, manager of marketing operations in central Ohio who presented a congratulatory placque to refinery personnel from the marketing division; and Daniel E. Sullivan, Pure Oil refinery chief engineer who set out location stakes in the wheat fields on which Heath was located. John Stadtherr, refinery chemist, presided.

In addition to civic and industrial leaders who were guests, other Pure Oil visitors were: Russel L. Vernor, Heath's superintendent from 1920 to 1923, who is now manager of marine operations at Beaumont, Tex.; Clyde L. Smith of Chicago, refinery chief process engineer who did some of Heath's original surveying; and Irwin L. Hostetler, of Nederland, Tex., former assistant superintendent of Heath and now in the same post at Pure's Smiths Bluff Refinery.

Henry M. Dawes, president, who was unable to be present, sent the following message to Heath employees: "There is nothing more satisfying than to be able to visualize one's accomplishments in some concrete way. I wish that I were one of those who can look back to the days when there were open fields where your magnificent plant now stands. I wish it had been my vision which conceived of the millions of barrels of oil flowing into the stills and the thousands of carloads of products going out. It is a monument to courage, enterprise and hard work. It is concrete evidence of what men can do working together."

The members of Heath's quarter-century service club are Ray T. Schuler, Charles G. Swart, William F. Nikolaus, Carroll E. White, J. Burl Fluharty, Otto E. Adams, E. E. McPherson, Elmer E. White, John E. Oberfield, Ralph C. Brown, Warren A. Rice and Charles R. Walters.

Sun Employes at Marcus Hook and Toledo Share Safety Campaign Awards

These employes of Sun Oil Co., at Marcus Hook, Pa., shared $1000 in war bonds for suggestions made in the company's 1944 Safety Campaign contest. A. W. MacMurtrie, left, manager of the refinery, is presenting a $500 bond to Charles F. Havercamp, electrician, first place winner. Others in the group are Jacob Mahla, construction boilermaker, $100 war bond for best slogan; Joseph W. Plummer, gas compressor operator, $100 bond for third prize in suggestion contest; Artemis Jenkins, $200 for second prize in suggestion contest and Edith Guyer, personnel, $100 bond for best poster

At Sun's Toledo refinery the five best safety idea men receive war bonds, from Norman L. Soutar, manager of plant protection and safety campaign director. He is congratulating Charles T. Keyser, Plant 3, who won a $500 war bond for the best safety suggestion of the year. Left to right, are Kenneth Parsons, chemist, third prize, safety suggestions; Roy Sayers, foreman, second prize, safety suggestions; Mr. Soutar, Mr. Keyser, Melvin Ory, Plant 3, first prize, safety slogans, and Walter E. Wood, loading rack, first prize, safety poster.

SMITH METER COMPANY OFFERS *Automatic*

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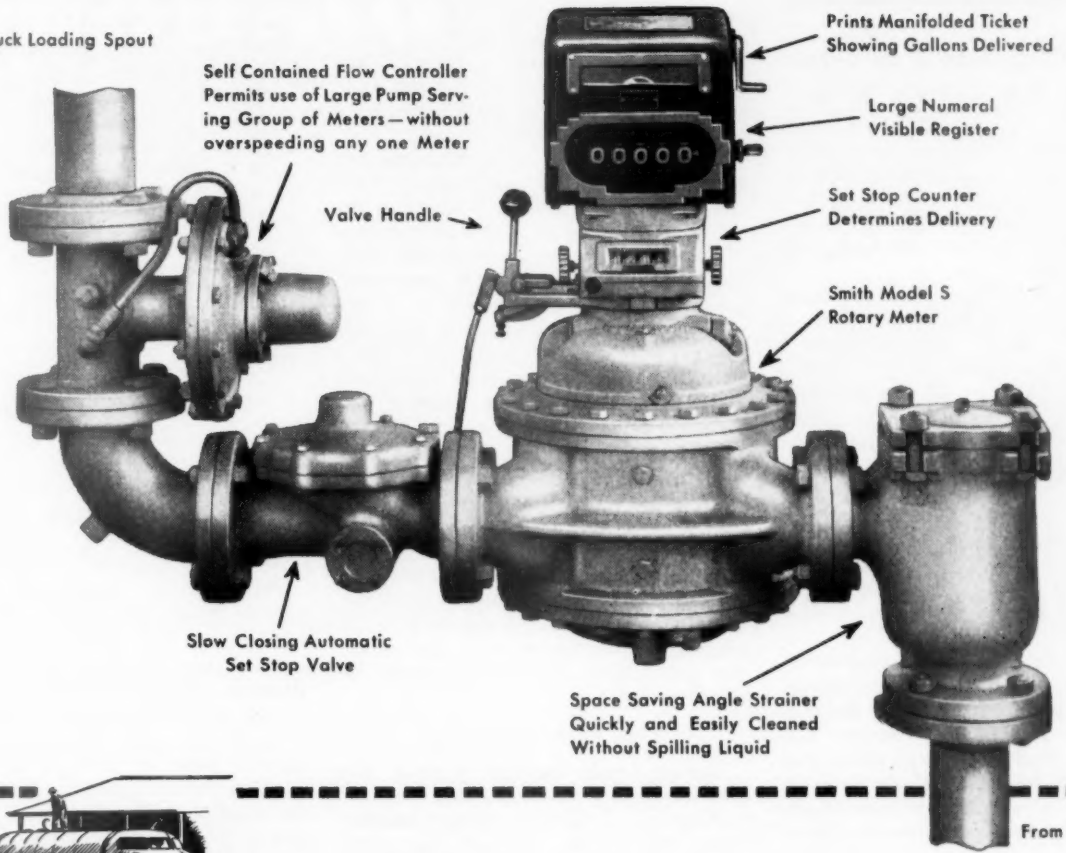
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Large Numeral Visible Register
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Truck Loading Racks equipped with meters having automatic set stop and ticket printing registers permit truck loading with a minimum of operators. One operator can easily load four trucks simultaneously without sacrificing accuracy or control of the loading operation. The result is lower operating cost and positive control of the quantity delivered. Smith meters are made in various sizes with equipment and accessories to suit varying delivery conditions. All are built on the simple SMITH ROTARY PRINCIPLE, dependable, accurate and fast, *the design that revolutionized the meter industry.*

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Chicago Corp. Hopes to Retain Tennessee Gas in New Setup

NPN News Bureau

CHICAGO—Officials of the Chicago Corp., in denying reports of intention to divest themselves of interests in Tennessee Gas & Transmission Co., on March 1 confirmed rumors that refinancing was being considered.

The reported plan for reshaping finances called for recapitalization of Tennessee Gas by the issuance of 50 or 60 million dollars worth of new securities, 44 million of which would be used to pay off an RFC loan in the same amount. Some nine million dollars of the remainder would be used for new construction of transmission facilities. The RFC loan schedules call for annual payments of $3,000,000 beginning on or before Dec. 1, 1945.

"This loan," said a company official "bears 4% interest and we may be able to beat that."

However, he labeled the present recapitalization plan a trial balloon, that is, tentative. A statement regarding the possible sale of interest in Tennessee Gas was also qualified by the explanation that the step will be taken "if Government action becomes such as to require divestment or it becomes an economic necessity."

Presumably the reference was to the pending decision by the Supreme Court in the Canadian River Gas Co. case, which is expected to clarify and define the regulatory powers of the FPC.

Operation of the Tennessee Gas & Transmission pipeline from the Southwest to the Appalachian region was at 105% of rated capacity during February.

Maritime Commission Requests Bids on 24 230-Ft. Tankers

NPN News Bureau

WASHINGTON—The Maritime Commission has asked sealed bids for construction of 24 new single-screw, diesel-powered tankers, largest single invitation issued since 1941.

Plans and specifications call for a 230-ft., single-screw model known as the T-1-M-BK1 type. Bids are returnable March 16, 1945, and construction schedule upon which bids will be conditioned calls for completion and saltwater delivery at an East, West or Gulf coast port not later than Dec. 31, 1945.

Alabaman Warns States' Selfish Restrictions On Highway Use Threaten Postwar Trade

NPN News Bureau

WASHINGTON — Speaking in the House recently, Rep. Sam Hobbs, of Alabama, asserted that to provide full employment for returning soldiers and workers now engaged in war production, it is essential that all obstacles to the free flow of goods be removed. It is only in this way that continuing production, employment, and purchasing power may be stimulated, he maintained.

Mr. Hobbs' talk dealt with the broad subject of trade barriers. His speech appeared in the Jan. 9 *Congressional Record*. Excerpts of the talk of particular interest to oil men follow:

"Today, virtually every state has imposed some form of trade barrier. There are well over a thousand of these restrictive measures on the statute books. The result is bitterness, retaliation, boycotts, and border wars. At a time when, as a nation, we are engaged in a war for the very preservation of life and liberty, there are guards on the borders of several of our States ready to enforce with guns these internal barriers to trade.

"Thus are we killing the goose that laid the golden egg. Thus are we destroying the very thing which made the United States the most prosperous country on the face of the earth, a free market in America for American goods and services. It is of the utmost importance to America today that we get back to the original premise under which the nation was established: 'United we stand; divided we fall.'

Cites High Restrictions

"Among trade barriers, nothing has been a more serious obstruction than the multifarious highway trade barriers which have been imposed by every state and many municipalities.

"The web of numerous and conflicting state laws and regulations which today hold motor carriers helplessly enmeshed is such a burden on the public that it is, inescapably, a public problem. In a single year over 10,000 bills affecting transportation by trucks were before the legislatures of our State. Over 1,200 were enacted into laws.

"That the railroads were the godfather of many of these laws, which are today keeping trucks off the highways, is attested by the very laws themselves. Texas, to cite only one of many possible examples, passed a law permitting only 7,000 pounds' weight, unless the truck were taking its load to a railroad station, in which event, 14,000 pounds was permitted. You may guess just once who had that law passed.

" 'Consider a picture of barricaded roads and highways guarded by men in uniform,' says a recent bulletin of the National Highway Users Conference. 'Envision long lines of travelers awaiting their turn to pass through the required formalities of proving their fitness to enter the country. Observe the arbitrary levying of imposts, the delay, expense, and inconveniences, and, finally, the issuance of the precious clearance certificate.

Many Laws in Conflict

" 'Such is the picture of a frontier—not a frontier of Manchoukuo, Soviet Russia, or a Balkan State—but a picture that is being witnessed along the invisible boundary lines between our states ° ° ° right here in the United States.'

"Not only are these laws myriad in number, but many of them are in direct conflict with each other. 'An Iowa farmer,' says a bulletin of the National Highway Users Conference, 'recently started for St. Louis with a load of canteloupes. He was stopped by the Iowa highway patrol at Mount Pleasant, where he was forced to install three green clearance lights. Shortly after dark, he parked in a Missouri town. Emerging from a restaurant after a hasty supper, he found his newly acquired green lights being torn from his truck by an irate policeman, who soundly berated him for violating the Missouri law.'

"On top of all that most states have some kind of license requirement and tax which must be met by out-of-state vehicles. Trucks entering most states are required to do one or more of the following: Register, deposit a cash bond, obtain a license or permit, pay ton-mile taxes, gross-receipt or personal-property taxes. It is self-evident that in some parts of the country these restrictions make a haul through several States utterly impossible.

"Innumerable instances of the burden on traffic could be given, but a record kept by one company of costs during one year for fines and penalties amounting to $14,651.13, with an additional $3,000 to $5,000 for preventing arrests —pay-offs—is a good enough example.

"The problem of interstate trade barriers is by no means local in its scope and effect, but is national. Every trade barrier, however small the area of its im-

Traffic Barriers Program To Be Broadcast March 10

NPN News Bureau

CLEVELAND—All persons interested in the vital problem of highway barriers were urged to listen to a dramatized broadcast on the subject by Highway Users Conference.

The broadcast, "Interstate Highway Barriers" will be on the air over NBC Saturday, March 10, from 12:15 to 12:30 p.m. EWT on a War Food Administration program.

WHAT'S BURNING

National Foam quickly and efficiently extinguishes these hazardous fires.

For many years, National Foam has been acknowledged by large oil refineries and, more recently, by the U. S. Navy as the effectual fire extinguisher to combat serious oil, gasoline and similar perilous fires.

National Foam quickly produces a thick, airtight blanket of tiny cohesive bubbles, shutting out the oxygen supply and extinguishing the fire. The foam is not dissipated by drafts or wind, but remains intact to prevent flashbacks.

National Aer-O-Foam and Equipment are now available in limited quantities for civilian industry. Experienced engineers will be glad to make recommendations indicating type of Foam and Equipment best suited to your individual needs.

BACK THE ATTACK—*BUY WAR BONDS*

In the recent Marshall Island raid, the Carrier Enterprise was hit by a Jap bomb firing both flight and hangar decks. Hightest gasoline blazed furiously. The ship's fire-fighting crew went into action with National Foam—in One Minute the fire was out.

NATIONAL FOAM SYSTEM, INC.

Specializing in Foam Fire Protection

Packard Building, Philadelphia 2, Pa.

A Glimpse of

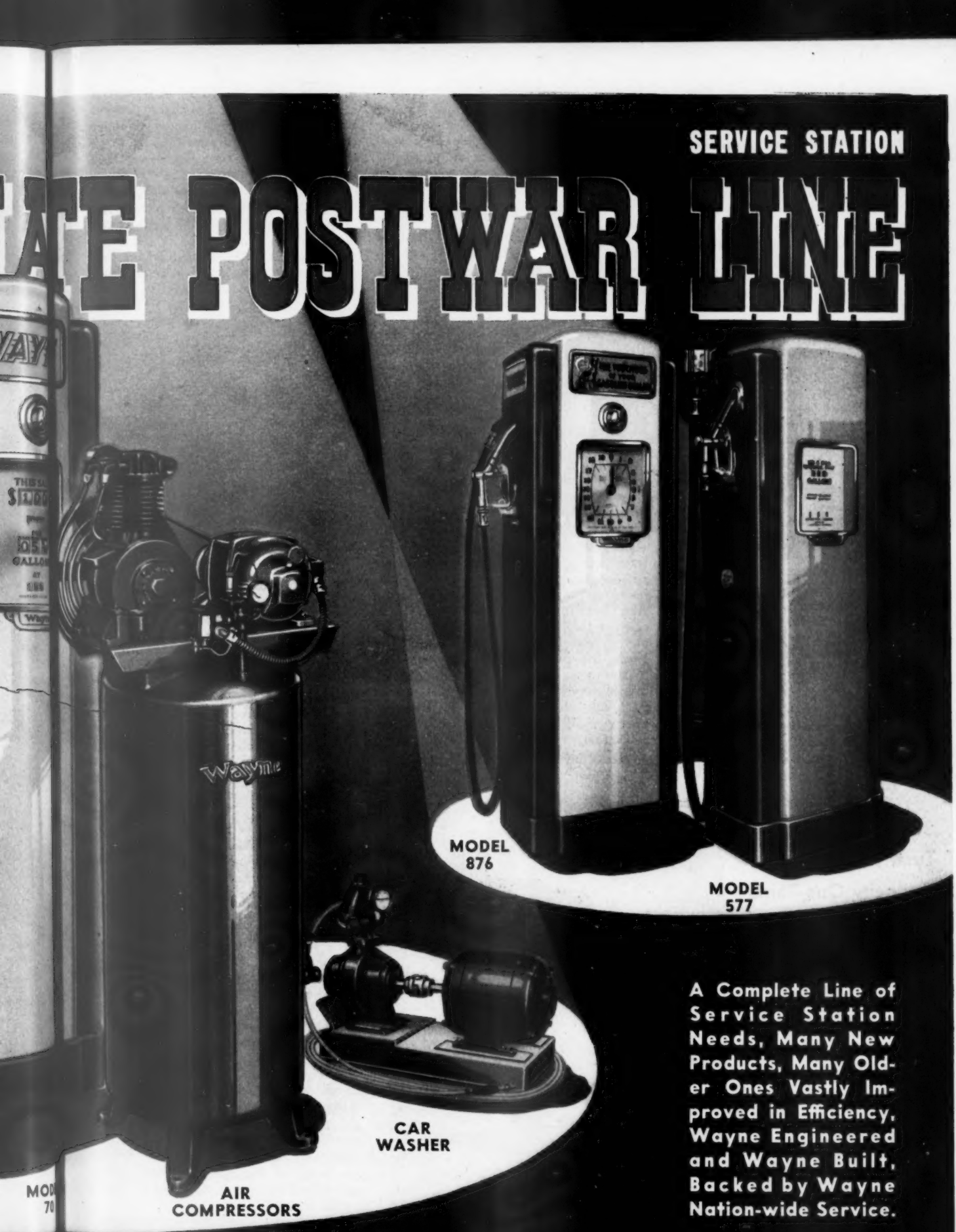
WAYNE'S IMMEDIATE

Today our facilities are engaged one hundred per cent in war work, but soon after Government restrictions are lifted, this improved Wayne equipment... built to fit the times . . . will be available

THE WAYNE PUMP COMPANY

SERVICE STATION

ATE POSTWAR LINE



A Complete Line of Service Station Needs, Many New Products, Many Older Ones Vastly Improved in Efficiency, Wayne Engineered and Wayne Built, Backed by Wayne Nation-wide Service.

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mediate application, has the effect of increasing costs and restricting trade and commerce to all the people.

"Our system of mass production requires the free and unimpeded flow of commerce—physical goods—between the states. It becomes each year an increasingly large part of all business.

"Interstate trade barriers deny to the American public the full benefits of mass production. They always raise prices, and, therefore, curtail production, thus actually reducing rather than increasing employment. Mobility of material is as essential to our peacetime economy as to the efficient operation of an army.

"While it is true the people of a state which has erected trade barriers around it do not pay more for many standard products and articles than anyone else, the increased cost of transportation and other restrictions is reflected in the price to all consumers.

"Thus by setting up trade barriers, a state works against the interest of all others of the 47 States, not just the ones immediately surrounding it. Trade barriers erected by Alabama raise prices in California, and trade barriers in Ohio raise prices in Alabama.

"For these reasons, all our people should be acquainted with the ill effects of trade barriers on them. All manufacturers, retailers, taxpayers, and consumer groups should see to it that barriers lifted during the war shall not be replaced and that current barriers be removed. ° ° °

"Thus, is the war between our States being fought today. Thus, have we established in our country a hundred frontiers on each side of which there is bitterness and ill will. Thus, are we defying our Constitution, that document which has made it possible in a war-torn world to retain our status as the freest and the richest country on earth. ° ° °

'All Such Barriers Bad'

"All such barriers, regardless of their intent or the means by which it is attempted to justify them, are bad. They restrict trade and commerce; add unjustifiable costs to goods, commodities and services; and reduce the national income which is so necessary to provide the full employment we must have if we hope to enjoy postwar prosperity.

"What is being done or can be done to rectify this reprehensible situation?

"There are two schools of thought as to the remedial action to be taken, First, and the most desirable one to our way of thinking, is by state action. The other, less desirable but which may be brought about by the failure of the states to act, is federal legislation.

"Already, strong and important influences are under way to correct by state action these laws and regulations which subvert and circumvent the plain intent of the Constitution. Much progress, largely sponsored by the Council of State Governments, has been made by mutual and cooperative agreements between the several states. As indicated by the name, the council is composed of official representatives of all the states. Each state should have a council of cooperation affiliated with the national organization.

"That the federal government is not unaware of the gravity of the situation and is in a mood for remedial action can probably best be exemplified by quoting from a letter recently written by President Roosevelt to Gov. Cochran of Nebraska, then chairman of the Council of State Governments, as follows:

" 'Interstate trade barriers have arisen in many instances from the same causes that resulted in mounting tariff walls between nations. The federal government is seeking to break down trade walls between this and other nations of the world, and to remove the hampering restrictions that have been placed upon world commerce.

" 'Interstate trade barriers, if allowed to develop and multiply, will however, constitute social and economic problems even more serious than international tariffs. It is a matter which demands the immediate attention of all the people of our country, and it is my earnest hope that the several states will take effective steps toward the removal of all barriers to the free flow of trade within our Nation.'

U. S. May Have to Act

"Again, at the Federal-State Conference on War Restrictions called by the President to clear away the 'legal obstacles arising from a desire for regional and local advantage' so that an unimpeded all-out war effort might be prosecuted, it was clearly indicated that the states must, or the federal government would, remove their principal barriers to the free flow of goods, supplies, and personnel during the emergency. The conference resulted in an admission by the states of the worst of such barriers and an agreement for their voluntary removal by the states for the duration.

"There has also been a midway proposal by which the Congress would provide for the appointment of federal-state commissions authorized to study and propose joint federal-state action.

"One feeling is that the States should take the necessary action to remove these barriers to commerce which are burdens on the public. However, there is no doubt that the Constitution gives a clear field to federal action in the event states fail to act. It is not unlikely that, in such cases, some such arrangement as that suggested with respect to a Federal-State commission may be the answer. Certainly, we should advise our business friends and associates of the conditions.

"Many of them do not know that such conditions exist, or that we all are paying for such narrow and short-sighted restriction on our commerce. Public knowledge of the conditions will influence a desirable result more quickly than anything else."

Section Added to Tank Trailer Ups Capacity One-Third

Lifting of state highway barriers will mean that operators will have increased capacity to haul petroleum products. Here is one example. When the vehicle size and weight restrictions were lifted in Nebraska, Eaton Transport of Pleasonton, had their tank-trailer lengthened, increasing its capacity about one-third. The work was done by a Fruehauf factory branch

L. B. Riddle Dead

NPN News Bureau

TULSA — L. B. Riddle, 55, independent oil producer and president of the Life Line Pipe Co. of Nowata, Okla., died here Feb. 22.

NEW TRUCKS—The government has authorized the manufacture of a limited quantity of International trucks for essential civilian hauling. See your International Dealer or Branch for valuable help in making out your application.

"WE WERE SKEPTICAL"

A Performance Report of 4 INTERNATIONAL KR-11's

from National Tank Truck Delivery Inc.

HERE'S UNIQUE testimony to the rugged stamina of International Trucks . . . A Performance Report from C. B. Wilhelmy, president, National Tank Truck Delivery, Inc., Columbus, Ohio . . . A Performance Report that tells about four International KR-11's that were not expected to be equal to their job.

"These trucks," Mr. Wilhelmy reports, "pull gasoline trains. Each train consists of two tank trailers and a dolly. The payload amounts to 8,000 gallons of gasoline, weighing approximately 50,000 pounds. The gross train weight is 83,680 pounds.

"The four trucks have been averaging 620 hours service per month; each travelling approximately 10,000 miles, hauling gasoline to Army Air Corps fields. All four units have been averaging three and one-half miles per gallon.

"We were skeptical of the ability of this unit to perform under the loads described, and in normal times, no doubt would have purchased considerably larger units. However, the Air Corps was badly in need of highway transportation, and the KR-11 was the largest truck available to us.

Owner:
National Tank Truck Delivery, Inc.
Columbus, Ohio.

INTERNATIONAL

4 Internationals, Model KR-11
Wheelbase: 161 Inches
Engines: International Red Diamond 450
Axle Ratio: 7.10 to 1
Transmission: Direct in Fifth
Two Tank Trailers and Dolly
Payload: 8,000 Gallons per Unit
Gross Train Weight: 83,680 Pounds

"We have been surprised and pleased with the fine performance of these trucks. They have been in operation for about six months and are daily doing an excellent job."

INTERNATIONAL HARVESTER COMPANY
180 North Michigan Avenue Chicago 1, Illinois

HARVESTER

INTERNATIONAL *Trucks*

Renews Indianhead's Struggle With ICC

WASHINGTON—Lester A. Wilsey, petroleum transporter doing business as Indianhead Truck Lines, Minneapolis, Minn., has filed exceptions to the report of ICC Examiner L. B. Dunn which recommended denial of Wilsey's application for a permanent certificate.

Mr. Wilsey requested "oral argument" of his exceptions, contending that, because of pre-1943 restrictive Wisconsin laws, "it was not practical before the war to transport petroleum products, in bulk, by tank trucks."

Mr. Wilsey made that statement in direct reply to Examiner Dunn's finding: "The record fails to show any inadequacy in the transportation services existing prior to the war, and fails to show any circumstance or condition not a result of or directly attributable to the war, which will necessitate additional services after the war, when, it may be fairly presumed, conditions will be more normal than at the date of the hearing."

In his exceptions (Docket No. MC104688 Sub. No. 1) filed by Attorneys A. R. Fowler and S. B. Houck, of St. Paul and Minneapolis respectively, Wilsey pointed out that before 1943, Wisconsin law prohibited transportation of petroleum products in tank trucks in excess of 2,000 gals., "from Superior, Wis., to Michigan, Minnesota, or Wisconsin destinations; from Minneapolis-St. Paul, Minn., to Michigan, and through Wisconsin to Wisconsin destinations. As a practical matter, it effectually barred all of the interstate transportation for which applicant seeks authority except that from Minnesota to Iowa."

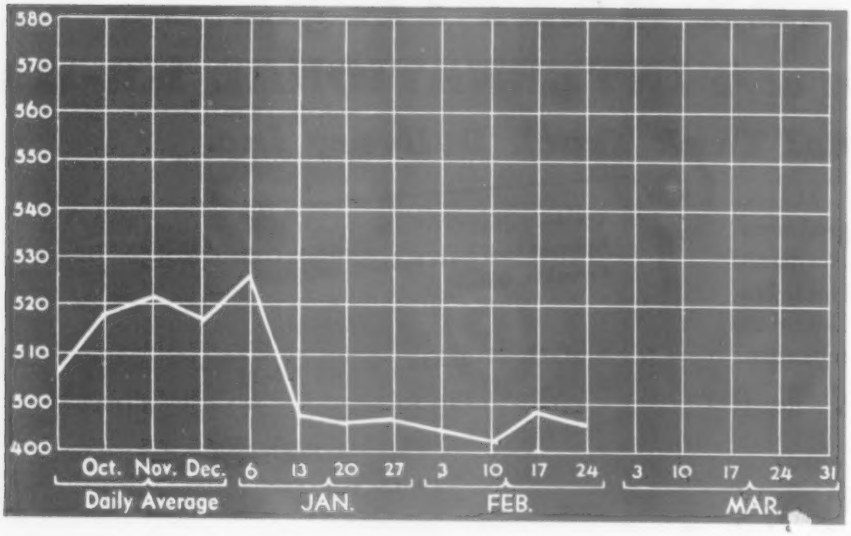
"In view of the situation resulting from the statute of Wisconsin," the plea continued, "no significance can be attached to the fact that prior to the repeal of the statute in 1943, motor carrier transportation of petroleum products in tank truck did not exist on the highways of the state. Shippers did not demand it because adequate motor transportation was not lawful. It could not be conducted practically or profitably."

Because of the Wisconsin statute, Wilsey argued, all pre-war transportation "necessarily was by railroad."

"The absence of transportation by motor carrier," or of demand for it, means nothing under these circumstances, the transporter said, adding that "for the present and for the future, in respect of the transportation of petroleum products, the repeal of the statute has completely changed the circumstances and conditions affecting such transportation."

ICC spokesmen meanwhile said that no date had been set for a hearing on oral arguments of Wilsey's exceptions.

Tank Car Hauls to the East Fall Off Again



NPN News Bureau

WASHINGTON — Tank car hauls of crude and products to the East Coast averaged 463,689 b/d during the week ended Feb. 24, compared with 487,826 b/d the previous week, PAW reported. Individual loadings were:

Allied	71	Elk Refining	50	Richfield	53
Allied Oil Co. (Ill.)	19	Franklin	1	Roosevelt Oil	1
Amsco	122	Freedom Oil	2	Root	52
Arkansas Fuel	117	Frontier Oil	19	Royal Petroleum	29
Ashland Refining	147	Gulf	1467	Shell	773
Asiatic Petroleum	4	Hartol	54	Sinclair	269
Atlantic Refining	826	Hess, Inc.	22	Skelly	6
James B. Berry Sons	2	Hunt	13	Socony-Vacuum	1560
Cantelou	27	Industrial	6	Southland	1
Chalmette	13	Jenny Mfg. Co.	9	Southport	29
Champlin	41	Libby	5	S. O. California	1
Cities Service Oil Co. (Del.)	148	Maritime Oil	49	S. O. Indiana	596
		Mid-Continent	16	S. O. Kentucky	77
Cities Service Oil Co. (Pa.)	280	National Refining	26	S. O. New Jersey	3285
		Pacific	27	S. O. Ohio	205
Col.-Tex. Refining	72	Pan American	720	Sterling	23
Continental	34	Petrol	5	Sun	1303
Cooperative Refining	6	Petroleum Heat & Power	20	Talco	5
Cosden	37	Phillips	295	Texaco	1197
Crown Central	46	Premier	27	Tide Water	102
Daugherty	27	Primrose	12	Tiona	1
Dornoil	5	Pure	447	Triangle	46
Drake	10	Republic	13	Wood River	27
Eastern	76				

Tire Quotas For March Same as February's

NPN News Bureau

WASHINGTON — March tire quotas for trucks, buses, farm tractors and implements, and passenger cars will remain at February figures, OPA has announced. OPA said that quota expansions in both truck tire and tractor-implement categories might be made in the spring-summer period, but added that "the large anticipated demand of that period would probably exceed any quota increase."

At the same time, both Col. J. Monroe Johnson, ODT director, and Max McCullough, deputy OPA administrator for rationing, re-emphasized the importance of prompt care and recapping of tires in use.

"In the face of our supply problems and the prospective demand," said Mr. McCullough, "neglecting to recap now may mean taking a vehicle off the road later on. We feel we have been able to satisfy most of the essential needs of passenger-car drivers having "B" or "C" gasoline rations during January and February. The primary reason for this is the decrease in demand for tires during the cold weather."

Johnson Gives Warning

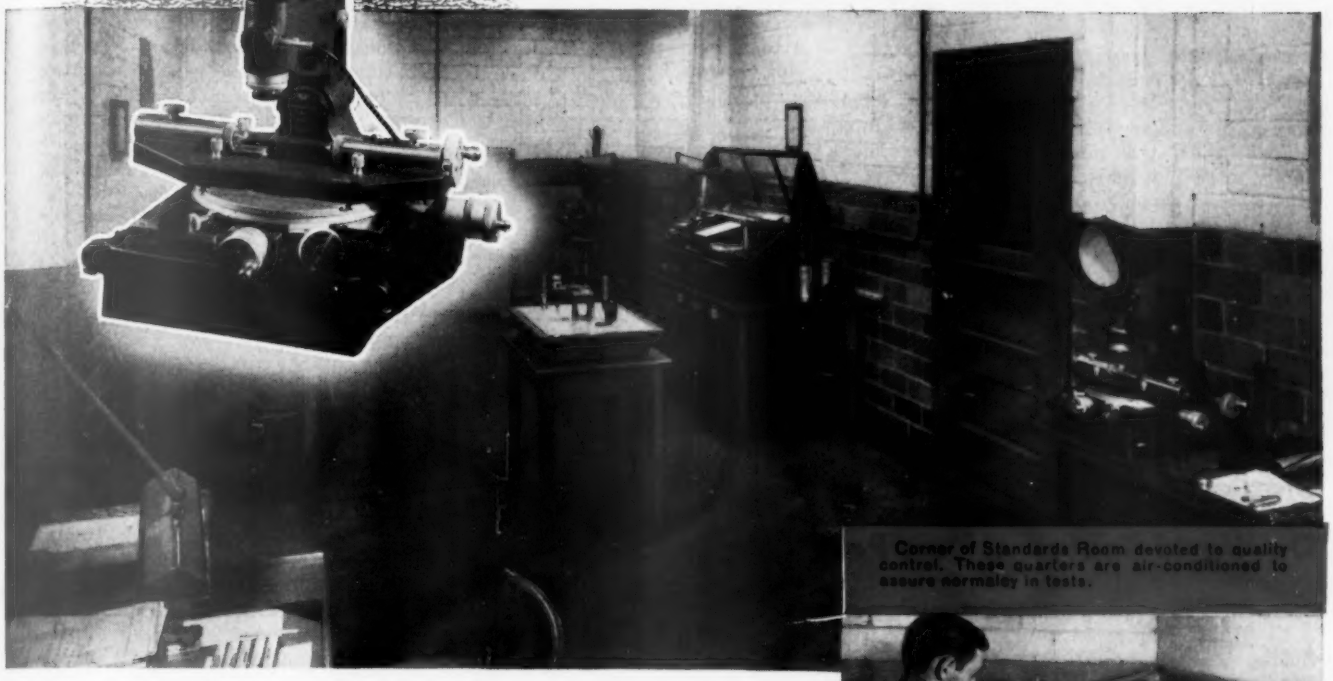
Col. Johnson warned of a "serious breakdown of rubber-borne transportation" if appeals to retread, recap and repair go unheeded, and pointed out that military demands for tires have been heavily stepped up as a result of battlefield experience in which tire consumption has exceeded previous liberal estimates of battle wear and tear.

"These increased military demands have reduced the number of tires which can be released for civilian uses," he said. "During March the number of small truck and bus tires, sizes 7.50 and under being released, totals 216,000, 28% below the average of 301,666 for the last six months of 1944. The number of heavy truck and bus tires, sizes 8.25 x 20 and larger (*see table below*) is about the same as the six months' average of 109,500."

The ODT director charged that the nation is "living far beyond its income

Profile of Perfection

Checking a production part in Zeiss Toolmaker's Microscope for correct contour against standard outlined on projection screen.



Corner of Standards Room devoted to quality control. These quarters are air-conditioned to assure normalcy in tests.

EXACTING *Standards Control* PROVIDES ACCURACY, BALANCE AND LONG LIFE IN PITTSBURGH-EMPIRE METERS . . . .

We deal in accuracy! Accuracy in the performance of meters made by production methods depends largely upon the accuracy of the tools, jigs and gauges that guide the manufacturing operations.

Our Standards Department is the backbone of PITTSBURGH-EMPIRE quality control. Here, in air-conditioned quarters, are assembled the most complete variety of precise measuring instruments obtainable. Every manufacturing tool, fixture and gauge is checked on regular schedule to guard against wear—to assure dimensional exactness in mating parts—to preserve the accuracy and sustained performance that skilled design engineering has so carefully detailed and charted.

With the aid of our Standards Department we can deal in probabilities too. We can pre-evaluate the performance of a meter and, through controlled manufacturing procedure, know with reasonable assurance that any one of its thousands of counterparts will duplicate this performance in the field.

Jones and Lamson Pedestal Comparator used to check tools for wear after service.

Pratt and Whitney Measuring Machine reads directly to 1/100,000 of an inch.

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MANUFACTURERS OF THE MOST COMPLETE LINE OF PETROLEUM METERS IN THE WORLD

and using up its inventory as well so far as tire consumption is concerned. We are like a family going steadily in debt, hoping against hope, that things will take a turn for the better before the sheriff shows up with a foreclosure notice."

Military Demands to Rise

"So far as the civilian motorist and truck or bus operator is concerned," he continued, "the present critical tire situation will perhaps continue throughout the entire year. Moreover, with improvement in the military situation in Western Europe which will further extend our supply lines, it is expected that military demands for tires will increase rather than decrease."

Asserting that minimum requirements for replacement and maintenance have exceeded available supplies for many months, Col. Johnson said that "unless concerted efforts are made to conserve existing tire supplies, we will continue to get closer to the day when a critically larger number of tires will wear out—and at a time when we can make only partial replacements."

OPA's March tire quotas, which prompted Col. Johnson's and Mr. McCullough's statements urging improved tire conservation, are as follows:

MARCH TIRE QUOTAS

Type of Tire	Quotas Allocated	Reserves	Total Quotas Available	February Quotas	January Quotas
Passenger & Motorcycles					
Grade I (new tires)	1,488,000	112,000	1,600,000	1,600,000	1,800,000
Truck & Bus					
Size 7.50 or smaller	203,000	12,960	216,000	216,000	216,000
Size 8.25 or larger	91,970	18,230	110,200	110,200	110,200
Tractor-Implement					
Size 7.50 or smaller	36,800	13,200	50,000	50,000	50,000
Sizes larger than 7.50	16,560	4,400	21,000	21,000	20,000

Biddle Urges End of 'Monopoly' in U. S. Airlines On World Routes; Offers Policy for Postwar

NPN News Bureau

WASHINGTON — Attorney General Biddle, presenting to Congress a 105-page report on "International air transport policy," this week urged that the U. S. adopt a policy of competition in the international aviation field, not restricting its operations to one company.

Adoption of this policy would put an end to Pan American Airways' development along "monopoly lines," he added, and competition would foster "prompt application of technical improvements" and reduce rates.

"The most convincing advantage of competition in the development of international air services arises from the fact that regulation alone, in the absence of competition, is unable adequately to protect either the interests of travellers and shippers or the larger public interest of the nation," the report said, and went on:

Monopoly View 'Persuasive'

"In the domestic field, where the regulatory authority's jurisdiction is coextensive with the operation of the air line and adequate to reach all critical phases of its operations, regulation is better able to protect the public. But in the international field, regulation is handicapped in the absence of competition because there are no yardsticks or criteria by which the regulatory authority can measure performance, judge efficiency, and experiment with the promotional effects of increased services and reduced rates. In the international field, the national regulatory authority does not have jurisdiction coextensive with the international operation. Therefore, competition performs a double function: First, of protecting shippers and travellers directly by assuring low rates and good service; second, of providing the government with a yardstick by which it may determine the amount and the form of public aid that should be extended to the international air carrier."

In the short run, the report conceded, arguments favoring the monopoly approach "may appear to be persuasive," but in the longer view advantages of competition "may far outweigh the advantages of monopoly."

When the United States is ready to make its decision, the attorney general pointed out, the choice need not be between the extremes of all-out unrestricted competition and a single company. Two alternatives he suggested: "Different companies may be given the American-flag operations in different geographic zones. One American company might operate the Atlantic service to Europe, a second might operate the services to Latin America, and a third might operate the Pacific services to Asia and the Indies. . . ." Establishment of regional companies, the report asserted, would simplify the problems of management—and this may be a controlling factor in the postwar world as development of air transportation is intensified.

A "second alternative" would be to provide "indirect competition on alternative routes." Biddle explained that for example, one company might operate the trans-Atlantic route to northern Europe, while the second operated to southern Europe. In Latin America a separation of Pan American Airways and Pan American-Grace would provide direct competition to Colombia and Panama, and indirect competition between the East Coast and the West Coast routes to Buenos Aires. Under this "alternative routes" plan, the report asserted, one carrier could operate by way of the Hawaiian Islands to Australia, the Indies, and China, while another could operate the northern route by way of Alaska.

Advantages of such a system were summarized as follows:

"The presence of two companies in the same part of the world would provide an opportunity to compare operating efficiencies, give to United States aviation the benefit of the experience of two companies instead of one, stimulate reductions in costs, and induce the prompt adjustment of rates to any savings in costs. . . . Finally, if military considerations or considerations of national prestige are thought to be important, the existence of two companies flying over alternate routes would seem to offer a greater advantage to the nation than either a single company flying the two routes or two or more companies flying the same routes."

Other highlights of Biddle's report to Congress were as follows:

(1) The United States must regard cartel control as a "threat to the future progress" of commercial aviation and as the deadly foe of competition.

(2) Creation of a sound and progressive international aviation industry "requires the establishment of an international organization to assemble and analyze factual information with respect to the operations of international air carriers and the laws and regulations of the various countries, the formulation of air traffic and safety rules, and the medium through which the aviation authorities of the several nations may consider and resolve common problems."

Wants CAA Power Widened

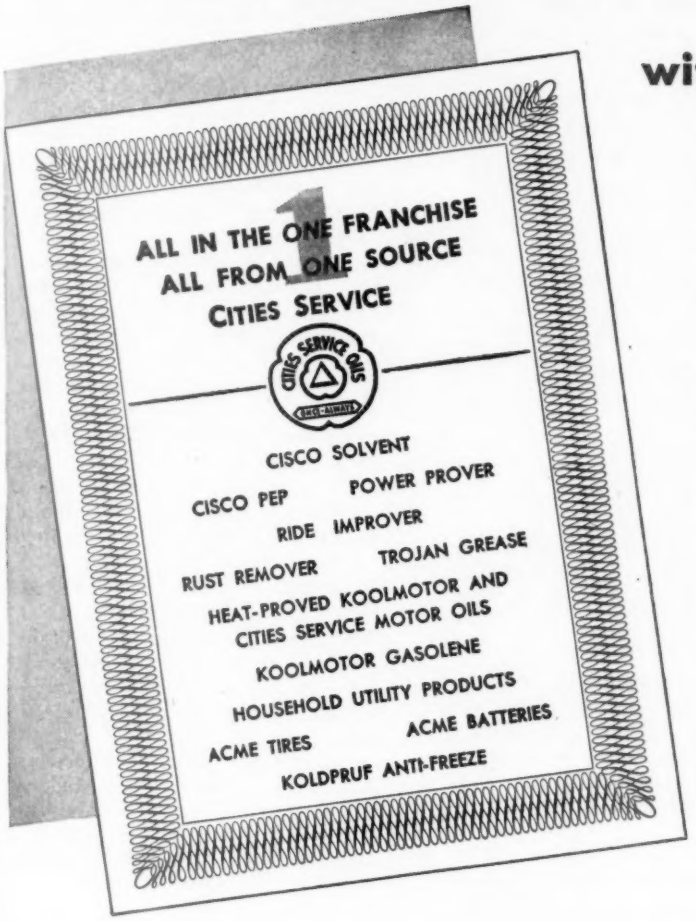
(3) Surface transportation companies should not own or control international air transport services, the report urged, because—as the air lines point out—larger capital resources of railroad and steamship companies, "plus their ability to carry unprofitable air operations for years on the basis of their shipping earnings, would ultimately result in the elimination of acquisition of all of the independent air lines."

(4) The Civil Aeronautics Board must be given jurisdiction over international carriers such as it now exercises over domestic carriers, because "only through an extension of its power will there be any assurance that United States-flag air lines will conform to the policies and practices adopted by our government. Jurisdiction over international air carriers will be particularly important if the policy of the United States favors a competitive development of our international air services."

(5) ". . . The best guarantee that United States international aviation will find a large sphere for service will be the encouragement and expansion of American trade and investment in all parts of the world, otherwise air transport can have only an insecure economic base in the foreign travel of American tourists."

ADD SPREAD TO YOUR FRANCHISE

with CISCO SOLVENT!



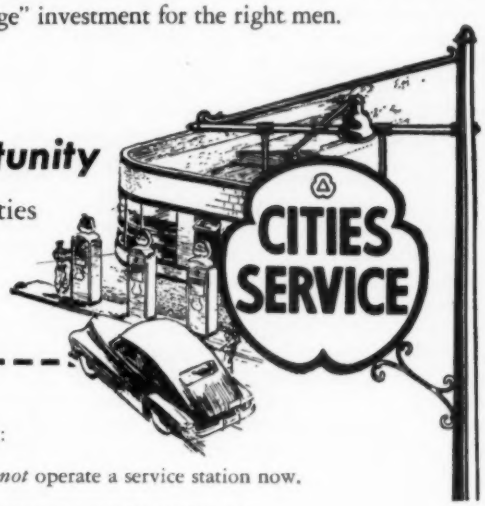
This internal engine cleaner is sold *only* by Cities Service dealers.

Fast-selling, fast-acting CISCO SOLVENT cleans moving parts of engines, transmissions and differentials. *More* effective than ordinary flushing oils, it quickly dislodges sticky gums, dirt and carbon particles . . . cleans out oil lines and passages . . . and even lubricates moving parts while it cleans.

Laboratory tests *prove* that CISCO SOLVENT is *superior* in cleaning power, speed and safety to competing products more expensively priced.

With the Cities Service franchise, you can sell the *exclusive* CISCO SOLVENT treatment with every lube change and net yourself a nice profit.

CISCO SOLVENT is only *one* of many money-making products Cities Service offers its dealers and distributors. Right after the war, the Cities Service franchise will be a "gilt-edge" investment for the right men.



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I am interested in further information, *without obligation to me,* about the post-war Cities Service franchise. Please contact me for an appointment.

Please Check:

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Texans Study New Limitations On Lift Gas and Condensate

Special to NPN

AUSTIN — A bill to give the Texas Railroad Commission power to reduce the amount of natural gas that may be produced in connection with the production of a barrel of oil is without a sponsor in the Texas senate.

Sen. Grady Hazelwood, who introduced the measure, asked and received permission to withdraw the bill. It would have given the Commission power to limit the amount of gas used to lift a barrel of oil to 3000 cubic feet, compared to the present 10,000.

A similar measure, introduced in the house, may reach the upper chamber for consideration, however.

Railroad Commissioner Beauford Jester, urging the reduction in lift gas, as well as power to prorate condensate, said:

"Production of condensate now is estimated at 218,000 barrels daily and is playing such a big part in production that when the war demand ends it will have a very unsatisfactory effect on crude demand, unless it can be prorated extensively with crude.

"The production of condensate is accomplished by the production of a large volume of gas and the proposed legislation would contribute immeasurably to correct wasteful practice.

"Present statutes permit 10,000 cubic feet of gas per barrel for jetting or lifting purposes. The Commission, however, considers anything above 3000 feet as wasteful, unless it can be shown additional quantities are necessary."

"Another section of the bill provides that the Commission, in considering nominations, shall determine how much waste and flared gas can be made available and deducted from the total requirements."

Pacific Coast A.P.I. Division To Meet in Los Angeles

NPN News Bureau

LOS ANGELES — Given the "go ahead" signal by ODT, the War Time Conference of the A.P.I. Pacific Coast District Division of Production has been scheduled for March 29 at the Los Angeles Biltmore Hotel.

It is expected that William Boyd, Jr., president of API and Deputy PAW Davies will speak.

Texans, Entrenched by Treaty, Ready to Fight Any Move by Ickes to Seize Offshore Land

Special to NPN

AUSTIN, Tex.—Back in 1845, when Texas pulled down the Lone Star flag from the capital and raised the Stars and Stripes, there was much official to-do over the signing of the treaty under which she came into the Union.

Most of the speeches have been forgotten, but the treaty is still in black and white for all to see. A hundred years later, Texas officials are mighty glad old Sam Houston and the other pioneers of the Texas Republic had the foresight to insist on an official treaty, with all Texas rights reserved.

For a report is sweeping the tidewater oil states that PAW's Harold Ickes has an impulse to take over submerged oil lands in the name of the federal government and issue federal drilling permits.

This was brought to light here when Assistant Attorney General W. W. Clary of California blew into town and immediately closeted himself with Gov. Coke Stevenson and Land Commissioner Bascom Giles. It was discovered that Mr. Clary came to Texas under instructions from the attorney general of California, who made the appointments with Gov. Stevenson and Mr. Giles by telephone.

Wants Solid Front

Mr. Clary would like Texas and the other Gulf states with oil production to be prepared to present a solid front to Mr. Ickes, if and when he makes a move toward his hip, where it is suspected the federal drilling permits are concealed.

None of the officials involved would be quoted for publication, on the grounds that they were merely interested in keeping their powder dry and were not eager to become involved in a fight with Honest Harold unless they have to.

The other states involved are California, Florida, Louisiana, Georgia and Mississippi.

Texas has leased some 200,000 acres of submerged coastal lands on which there are 164 producing wells bringing in around half a million dollars monthly in royalties to the state school fund. Texas officials made it plain that they would not sacrifice this much money, with an even greater potential looming for the future, without going to the mat with Ickes or anyone else attempting to set aside state jurisdiction.

Texas is in a much stronger position than the other states because when she became a state the United States accepted the stipulation, written in the treaty, that the state would have jurisdiction over all coastal lands and the submerged areas three marine leagues out from shore. Constitutional experts find it hard to see how the federal government could intervene and issue federal drilling permits within these boundaries.

The other states, however, wanted Texas to pitch in with them on an even legal keel, waiving her treaty rights in the interest of putting up a solid front.

This Texas refused to do, telling the envoys, in effect, that any time Mr. Ickes made a pass at California's submerged lands, Texas would pitch in, but as a co-belligerent.

In 1938-39 the Navy sought to take over the submerged coast of Louisiana and parts of Texas, but was balked by prompt Congressional action. The states apparently have wind that another such move is in the making.

At present, all leases on Texas' offshore lands expire at the end of 25 years regardless of whether there is production. Mr. Giles thinks this is holding back leasing, and there is pending before the State Legislature a bill to eliminate the 25-year clause and permit lessees to pay a minimum of $2 an acre per annum beyond that period, with power to the State Land Board to fix the rental at any figure it desires.

Drilling operations off shore in many parts of Texas have been curtailed due to war restrictions. When the war is lifted and the 25-year lease clause is eliminated, Texas oil circles expect the number of sea-going rigs to increase greatly.

At this time one producing well on the upper coast, the farthest from shore, is 9,200 feet out, well within the three-league limit of approximately ten and a half miles.

So with all this extra revenue looming for the school fund, and with federal control of anything Texan highly distasteful anyway, Mr. Ickes can expect a stiff fight on his hands on any "by sea" invasion.

Illinois Oil Output Holds Up; Some New Strikes Reported

Special to NPN

URBANA, Ill. — Daily average production of Illinois oil fields was 204,000 bbls., according to the State Geological Survey. This is the same rate as January's, but since February had fewer days, total production for the month was only 5,706,000 bbls. compared with 6,338,000 bbls. for January.

Drilling operations last month uncovered one new field, the Keenville pool and extended the Clay City Consolidated pool, both in Wayne County. Other extensions were to the Albion East pool in Edwards County, and the Thackery pool in Hamilton County. New pays also reported are the Waltersburg sandstone in the Cowling pool in Edwards County and the McClosky limestone in the Herald pool, White County. Outstanding competition of the month was in the Clay City Consolidated pool, a well flowing 1760 b/d initial from the McClosky. A total of 107 wells were completed in all fields during February, 72 of which were oil producers.

Then, I wrote a letter to the old man—

"I MUST have been just plain crazy, wanting to quit our truck operation. You were right when you said it's the best business in the world. Uncle Sam has taught me plenty about motor transport—and believe me, that's where my bread and butter are coming from when this war is over.

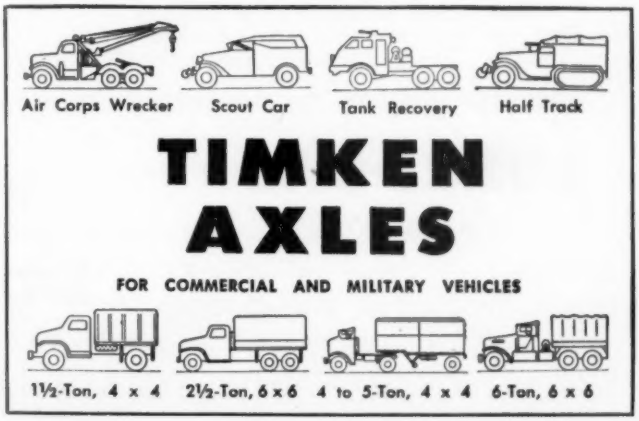
"I've seen what the Army is doing with military vehicles that fit the job, and common sense tells me that we can do the same thing with commercial vehicles after the war. Just think of the task to be done, putting the world back together again—and try to imagine doing it without trucks.

"Yes sir, from away over here I can see that more and more trucks are going to be needed to move an even bigger share of the nation's goods, quicker and at lower cost. I'm convinced that the best opportunity in the world for a guy like me is right back where I started. That's why I am looking forward to the time when I can come back and help build our little operation into something really big."

• • •

MOTOR TRANSPORT will offer real opportunities for new thousands when wartime restrictions are relaxed.

Regardless of what your hauling operation is—whether it is one of hauling crude oil, transporting petroleum products to market, handling oil field supplies and equipment, or local delivery of fuel oil, gasoline, kerosene—manufacturers will be ready with a wide selection of vehicles to fit *your* job. And Timken will be ready with improved Axles and Brakes, backed by 39 years of Axle Engineering experience, to meet the requirements of every vehicle manufacturer. The Timken-Detroit Axle Co., Detroit 32, Michigan. Wisconsin Axle Division, Oshkosh, Wisconsin.



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From every section of the nation Lubri-Gas dealers report an enthusiastic public acceptance of Lubri-Gas Treated Gasoline. This modern motor fuel makes motors run smoother and last longer. It produces more pep, more power—and gives more miles per gallon. Read this typical letter...

"We have a Shell bulk plant in Helena, Montana, operating under the name Andy's Oil Co., and we own and operate all service stations. Our normal gallonage is 1,000,000 gallons per year. We have sold your Lubri-Gas in all our stations for about eight months and we are more than pleased with the public acceptance. They all agree that they have a smoother running motor, no sticking valves and better mileage. I drive a Cadillac and use regular gasoline treated with Lubri-Gas. I drive back and forth over the Rocky Mountains all of the time without a sign of a knock and my mileage has been improved. I would hate to run the stations without it. We have one small station where we do not sell Ethyl, just regular untreated and regular treated with Lubri-Gas and sell 2 to 1 of the treated.

"We are also selling a lot of farmers for their tractors and they feel they are well repaid for the extra expense."

J. A. Anderson, Andy's Oil Co., Billings, Montana

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is Premium Plus because it is not only Anti-Knock, but also Anti-Friction, Anti-Carbon, Anti-Gum, Anti-Sludge.

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O.K.'s Lines to Give Appalachians Gas

NPN News Bureau

WASHINGTON—The War Production Board last week provided for flow of an additional 110,000,000 cu. ft. daily of natural gas into the Appalachian region next winter by approving two pipeline projects, both involving the northward line of Tennessee Gas & Transmission Co. from Monroe, La.

One project involves the addition of four compressor stations on the Tennessee Gas line from Monroe to West Virginia. To be installed near Greenville, Miss., Middleton and Springfield, Tenn., and Frenchburg, Ky., they will make possible the delivery of an additional 60,000,000 cu. ft. daily, WPB said. Cost of the four stations is estimated at $5,000,000, and will be financed by Defense Plant Corp. An AA-1 priority was authorized.

The other project, also given AA-1 status, involves construction of about 140 miles of 24-in. pipeline by the United Gas Pipeline Co., at a cost of $7,000,000, from the Carthage gas field in Texas to tie-in with the Tennessee Gas & Transmission Co. line at Monroe. WPB stated that this line is necessary "to assure additional deliverability of the T. G. & T. line as well as strengthen deliverability of gas on other major pipelines out of the Monroe field serving the southeastern U. S.

Both United Gas Pipeline and Tennessee Gas have applied for necessary authority from FPC, but no dates for hearings have been set.

Panhandle Eastern's application for construction work to expand capacity of its deliveries from the Hugoton gas field to the Michigan-Ohio area, by 50,000,000 cu. ft., approved by OWU two weeks ago, is currently up for hearing before FPC.

Rival Texas-Ohio Gas Proposals Sighted in Pipeline Hearing

NPN News Bureau

WASHINGTON—Metropolitan Eastern Corp., of Wilmington, Del., has filed application with FPC for authority to construct and operate an 825-mile, 18-inch natural gas pipeline from Carthage field, to Hamilton, O. The application, signed by H. E. Lauman as corporation president says the line would have a capacity of 140,000,000 cu. ft. daily, and would cost about $23,500,000. Construction would begin in April and be completed by Oct. 31.

The announcement that application had been filed was made by FPC Attorney Charles E. McGee at the hearing on Panhandle Eastern Pipeline Co.'s application for authority to construct and operate new compressor facilities to increase deliveries to Ohio Fuel Gas Co. at Maumee, O., and Muncie, Ind.

Questioned by Mr. McGee, who said proposed pipeline would reach "almost to the back door" of Ohio Fuel Gas Co., Ohio Fuel President C. I. Weaver said that he had "no notion at present to pur-

chase extra gas" from Metropolitan Eastern.

Mr. Weaver said, however, that he had been approached on this by Ross Holmes, engineer for that firm, and added that if Panhandle's application and one expected to be filed by Tennessee Gas & Transmission Co. were both approved by FPC, Ohio Fuel probably would not require deliveries from Metropolitan Eastern.

Appalachian Plants Are Ordered To Keep On Burning Residual

NPN News Bureau

WASHINGTON—WPB's Office of War Utilities last week ordered industrial plants in the Appalachian area which have standby facilities to continue burning residual fuel oil until March 20 instead of natural gas.

The order was issued after PAW assured OWU that residual requirements could be met. All of the plants concerned are in Virginia, W. Virginia, Maryland, Ohio, Pennsylvania, New York and the District of Columbia and normally consume approximately 50,000,000 cu. ft. of natural or mixed gas daily.

Reports 71,000 Californians Employed by Oil Industry

NPN News Bureau

LOS ANGELES — A total of 71,000 persons is employed in the oil industry in California as of September, 1944, the California Division of Labor Statistics revealed last week. They are divided as follows:

1. Petroleum producing, including drilling, 22,000.
2. Manufacturing, including refining and manufacture of petroleum products, and central administrative office personnel, 25,000.
3. Trade, including bulk and retail filling stations, 24,000.

Owners and own-account workers are not included in the figures.

John R. Alexander Named Head of Texas Dixie Distributors

Special to NPN

FT. WORTH—John R. Alexander, of the Alexander Oil Co., Lorenzo, was elected president of Dixie Distributors of Texas at the organization's regular meeting recently. Ed. Connerly, of the Connerly Oil Co. was elected vice-president; Odis H. Gray, of Independent Oil Co., secretary; T. C. Orr, of Dixie-Orr Oil Co., Corsicana, treasurer, and Mr. Gray was also elected delegate to the National Dixie meeting in Kansas City in April.

Unitization Topic of Lecture

Special to NPN

DALLAS — J. R. Butler of Shreveport, La., gave an illustrated lecture to the Petroleum Engineers' Club here Feb. 23 explaining the planning and operation of unitized properties from which oil and gas are produced.

Mr. Butler is general manager of the Cotton Valley Operators' Assn. and the Haynesville Pool Operators' Assn.

BEHIND THE PLANES' ANGRY ROAR....
Speed is a vital factor in readying our mighty bombers and fighters for their all-important missions. And at army air bases all over the world, MILVACO valves and fittings are helping to feed the fuel that keeps 'em flying—saving precious minutes where time means most.
MILVACO valves and fittings are designed and engineered to provide a higher speed discharge in refueling operations—to maintain a smooth, constant, full and faster flow.
And this same precision workmanship, accuracy and unfailing dependability, now serving so many military uses, are embodied in MILVACO'S regular line of commercial valves and fittings for the petroleum industry which are now being produced for your more urgent needs.
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Dad Is 'Proud' as Nation's Top Military Honor Goes to Driller Who Stopped Tiger Tanks

FORT WORTH, TEX. — R. B. Fields, drilling superintendent for Roeser & Pendleton, Inc., of Fort Worth, was "happy and proud" when he was told over the phone that his son, Lieut. James H. Fields, had been decorated with the Congressional Medal of Honor for conspicuous gallantry in France on Sept. 27.

His office here informed the father of the honor of one of his four fighting sons in a long distance call to Laurel, Miss., where he is presently employed.

Lieut. Fields, described as small and wiry, was an oil field driller himself before going into the army. He is with Gen. George S. Patton's Third Army and the first man in this fighting outfit to receive the Congressional Medal.

Press dispatches told of the award "in a simple ceremony within sound of German guns."

Patton Awards Decoration

Gen. Patton, the accounts said, snapped the division to attention while he read off the citation for the nation's top military award.

"Here, only a few miles from the lines where heroes are so numerous they have become almost commonplace, the Fourth Division's tankers and doughboys took time out to remember the men who didn't come back from Hill 265, near Rechicourt, France, last Sept. 27," a United Press dispatch read.

"The slim Texan looks more like the oil driller's helper he was before the war than the super-soldier he is now, but this is what he did that day near Rechicourt:

Sent to Fill Gap

"Fields' platoon was ordered up to Hill 265 with two light machine guns to fill a gap left when two platoons were knocked out of action.

"He went up with 55 doughboys and he came back almost 24 hours later with 13, but his platoon wiped out a German platoon supported by artillery and two Panther tanks.

"Fields and his men moved into line under cover of darkness. At daybreak the Germans hit them. They beat off the attack but one American was hit and left out in the open.

"Fields went after him and got a bullet in the face. The shot went through his cheek and out the other side. It tore his tongue and filled his mouth with bloody fragments of jawbone.

"Unable to speak, he stuck with his platoon and directed their fire with hand and arm signals, sometimes writing notes to be passed from foxhole to foxhole.

"The pain was so terrible that Fields gave himself first aid by cramming a compress into his mouth. He held another compress over his right cheek and kept firing with his left hand.

Three Tanks Driven Back

"The three Nazi tanks opened an attack, and, when Fields shot the commander of the leading tank, the enemy withdrew.

" 'I'll never know to this day why they didn't overrun us,' Fields was quoted as saying. 'We had nothing to halt them with, but no one thought of withdrawing.

" 'Those damn tanks were so close they were firing direct fire into the top of our foxholes with 75's.'

"When the Germans finally pulled out, Fields ran, walked and crawled a half-mile to his battalion aid station. Before he accepted first aid, he drew a detailed map of the platoon sector and the enemy positions which later helped his battalion to drive the Germans out."

Lieut. Fields also has the Silver Star, the Purple Heart and the Combat Infantryman's badge.

His father said Lieut. Fields was already back in action. He was born in Caddo, Tex., was educated at Houston and Norman, Okla.

'Bret' Recalls Louisville Meet of 1910

NPN News Bureau

CLEVELAND—Memories of good times at an oil convention 35 years ago came to F. C. Bretsnyder when he read the Feb. 14 issue of NPN.

A story on page 18, telling how NPN's advertising regulars dramatized 35 years of oil progress showed a section from a photo of a group which attended the first meeting of the Independent Petroleum Marketers Assn. in Louisville in the summer of 1910.

In the picture was Warren C. Platt, who only the year before had founded NPN and was secretary of the new association.

Mr. Bretsnyder, now president of the Porter Oil Refining Co., St. Louis, immediately spotted his own picture in this group. His was the fifth from the left in the top row. He immediately wrote Editor Platt the following note:

"This is Bret. Just want to let you know that we are still reading your paper. Also, I am one of the group shown in the Feb. 14 issue of National Petroleum News.

"It was I who made the motion to make your paper the official organ of the oil association.

"We are still going strong. I will never forget the many good times we had at the convention."

Seek More Trained Engineers To Enforce Texas Oil Code

Special to NPN

AUSTIN, Tex.—More better-trained engineers to work with the Texas Railroad Commission in enforcing oil orders and gathering oil and gas data will be asked of the Texas Legislature.

The plan to extend the staff was outlined at the state-wide oil proration hearing here after Tom Graham of Corpus Christi noted to the Commission that its engineers were resigning regularly to join private industry.

"An oil field roughneck is drawing as much money as your engineers," he said.

Mr. Graham also noted that the Commission annually turns back large sums into the state general fund. The enforcement fund last year returned $800,000, he said.

Chairman Olin Culberson outlined the plan to be taken up with the legislature. It would call for 10 men, designated as engineers, at $250 per month, all to be graduates of a four-year accredited engineering course from a university.

Another eight men would be employed as junior engineers at $3600 per year with the same scholastic qualifications, but with the additional stipulation that they be employed at least one year with the Commission. Four top engineers would be employed at $4000 per year, with the same qualifications but with two years of experience with the Commission, as senior engineers.

Col. Culberson estimated this would require an additional $63,000 a year on the Commission's budget.

Natural Gasoline Production Boosted 15% Above 1943

NPN News Bureau

WASHINGTON—Daily average production of natural gasoline and allied products attained a new high of 12,990,000 gals. in December. Total production for 1944 was 4,226,754,000 gals., the Bureau of Mines reported.

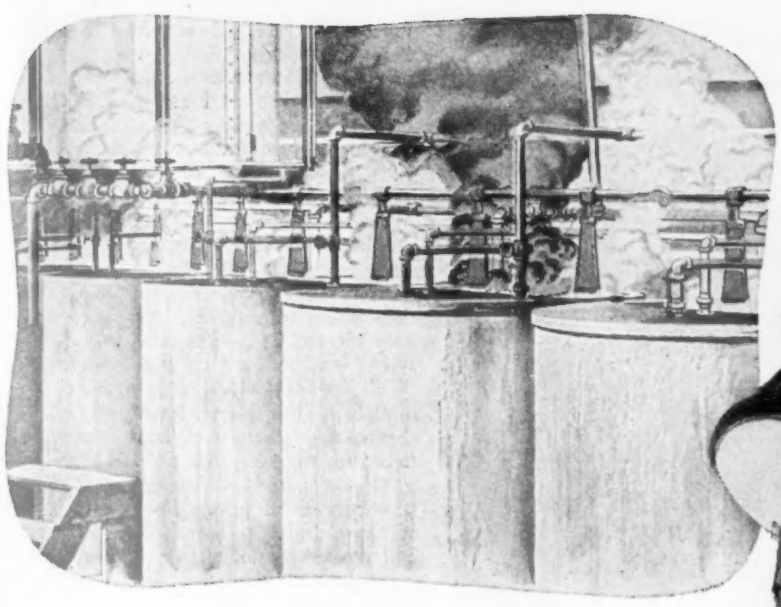
The later figure is 15% greater than that for 1943, with greatest growth in output being achieved by Texas, Louisiana, California and Arkansas in that order.

Stocks as of Dec. 31 were 178,584,000 gals., down 3,444,000 gals. from the previous month and 12,138,000 gals. below Dec. 31, 1943. Of the year's decline, all occurred at refineries.

Socony Annuities at $3,750,000

NPN News Bureau

NEW YORK — Socony-Vacuum Oil Co., Inc., paid out $3,750,000 in annuities last year to more than 2500 former employees, the company announced last week.



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● Just a *hint* of a blaze in a flammable liquid...and a Kidde built-in system goes into action fast. A blanket of carbon dioxide covers it like a candle-snuffer...out goes the flame before it can spread!

Fast fire-killing is just *part* of the Kidde method. The "after it's out" advantages are equally outstanding. The dry, inert gas leaves no mess to be cleaned up—keeps the liquids themselves *uncontaminated, undiluted.*

Against electrical fires, Kidde systems are equally fast, equally safe. *Fast,* because carbon dioxide quickly penetrates wiring and windings. *Safe,* because there's no water-soaking of equipment or rotting of insulation.

Class B fires in flammable liquids, Class C blazes in electrical equipment... these are the *tough* fires to fight. The ones against which ordinary water-type extinguishers are useless. *But* the ones for which underwriters specifically approve Kidde equipment.

Before one of these hard-to-fight fires gets a chance to damage your plant, study the accompanying list of danger points. Then ask a Kidde representative how best to protect them.

Kidde Kills Tough Fires

PROCESS ROOMS
OVENS
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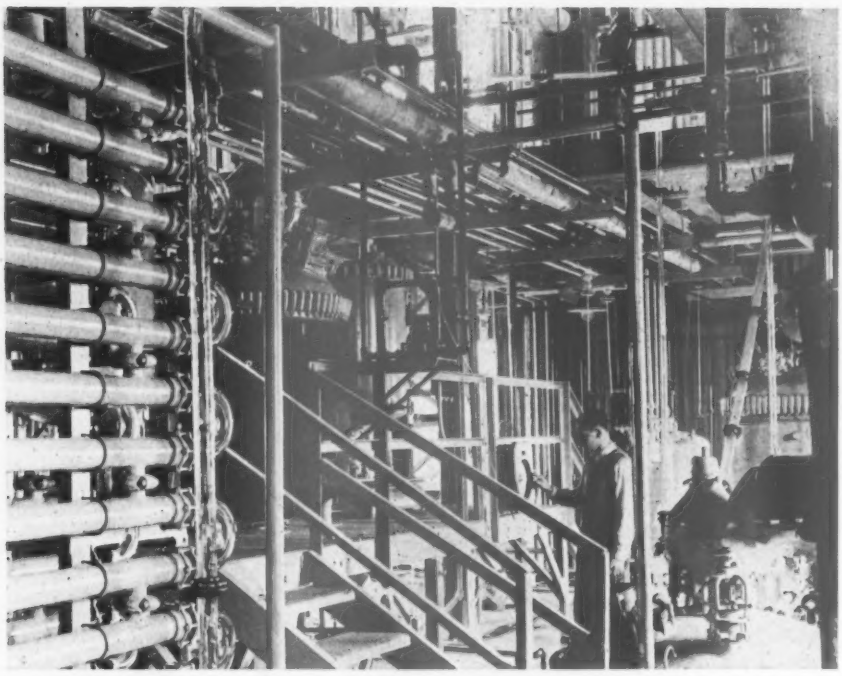
Phillips Completes Ultra-Modern Pilot Plant In Texas to Make Rubber in Glass Piping



Interior view of Phillips new rubber polymerization pilot plant. Glass-lined heat exchangers are clearly visible in left foreground as is some of the glass piping, while just beside them and, also in lower right corner, are two glass-lined reaction vessels

Special to NPN

BARTLESVILLE, OKLA. — The synthetic rubber pilot plant which was in course of construction when the Research Department's "open house" was held at Borger, Tex., Jan. 5, has been completed, according to word from Phillips Petroleum Co. A distinctive design feature is the use of glass-lined vessels and glass piping at all points in the process where contamination or catalysis by metals of latex and raw materials is possible.

The plant contains diversified equipment for distillation and purification of butadiene and styrene. It has polymerizers, a coagulation unit and filtration and drying equipment. Facilities are large enough to produce sufficient rubber for full-scale processing and tire tests. Auxiliary refrigeration equipment, a small scale polymerizing unit and raw material storage space are in an adjacent one-story building.

Experimental studies intended to produce better-quality polymers now are being conducted by a staff of chemists and chemical engineers under the supervision of J. E. Troyen. Mr. Troyen was recently associated with the Process Development Section, Office of Rubber Director.

Dr. Lucas Kyrides Is Winner Of A.C.S. Midwest Award

Special to NPN

ST. LOUIS—Winner of the first Midwest award of the American Chemical Society is Dr. Lucas P. Kyrides, research director of Monsanto Chemical Company's organic chemicals division.

The award, a gold medallion, is to be given each year by the Society's St. Louis section to the individual adjudged most outstanding in the point of "meritorious contribution to the advancement of pure or applied chemistry or chemical education." Eligible for the honor are chemists residing in Missouri, Kansas, Iowa, Oklahoma, Nebraska, Arkansas, Kentucky, Tennessee and Illinois.

Dr. Kyrides, born in Turkey of Greek parents, pioneered, among other outstanding accomplishments, the development of synthetic rubber substitutes in this country, perceiving the possibilites of isoprene, butadiene and dimethyl butadiene, working out the synthesis of workable processes for these hydrocarbons and guiding the fabrication of America's first set of synthetic tires.

Dr. Kyrides, credited as the discoverer of many drugs, has been associated with Monsanto Chemical Co. since 1928.

National Refining Reports On Sale of Properties

NPN News Bureau

CLEVELAND—Net profit of $978,569 for the year 1944 was reported by National Refining Co.

The company's financial report is not comparable with the previous year because of changes in corporate set up.

In January, 1944, the company sold, for a price slightly in excess of aggregate net book value, its refinery at Coffeyville, Kans., the pipeline system serving the refinery, the major part of the company's production properties, and other miscellaneous capital assets. In course of 1944 the company also sold all its remaining service stations and bulk plants with the exception of the bulk plant here, a bulk plant and service station at Marietta, O., and a service station at Decatur, Ill. Aggregate book loss resulting from the sale of such service stations and bulk plants and from marketing department equipment, less the small gain on the properties sold in January, 1944, was charged against the reserve of $1,700,000 which was provided for in 1943. Thus the net loss on the sale of depreciable assets and land is not reflected in the net profit for 1944.

The company's marketing activities are now carried on principally in the states of Ohio, Indiana, Illinois and Michigan and the territory along the upper Mississippi River. With the elimination of company-owned bulk plants and service stations the products of the company are sold through jobbers and direct to railroads, industries and other consumers.

On Dec. 1, 1944, the company redeemed all of the outstanding prior preferred stock, with the result that the company now has outstanding only common stock and a small number of shares of 8% cumulative preferred stock. In 1944 the company paid all accrued dividends on the 8% cumulative preferred stock, and there are no dividends in arrears on the shares of such stock now outstanding.

Sun Reports Gain Over 30% In 1944 Refinery Runs

Special to NPN

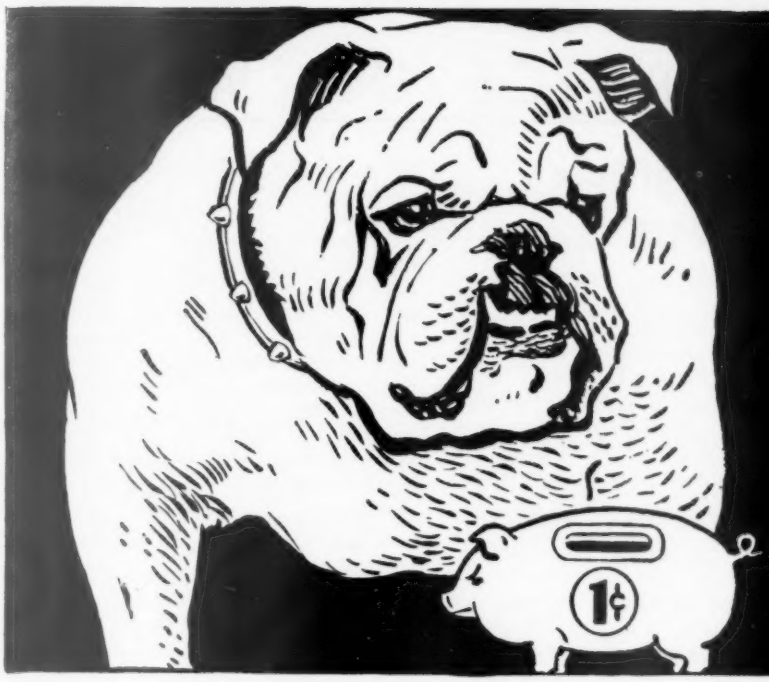
PHILADELPHIA — Crude runs to stills in Sun Oil Co.'s refineries were up 30.5% in 1944 to 54,777,107 barrels, indicating operations at 93.5% of rated capacity, J. Howard Pew, company president, said in a report to stockholders issued Feb. 26.

Sun's Marcus Hook (Pa.) refinery now has the largest catalytic cracking capacity of any refinery in the world, 125,000 barrels per stream day under optimum conditions, the report said.

The Sun Oil president said his company's broad experience with catalytic cracking covering a period of 12 years, "has served to confirm the soundness of our original judgment and to increase our enthusiasm over the possibilities of the Houdry fixed-bed process."

"The moving-bed catalytic processes," Mr. Pew said, "have worked satisfactorily for the purposes for which they were designed, and in special situations they may have some superior characteristics. But for general refining purposes we have found nothing that offers greater promise.

"Particularly appealing is the flexibility of this process and the wide range of possibilities it offers for future improvements. All our research indicates that up to this time the Houdry fixed-bed process provides the best instrument for further improvement in catalytically-cracked gasoline."



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THE JOB COMPLETE FROM BLUEPRINT TO FINISHED PRODUCT

Survey Urged to Determine Fairness of Base Period Pricing for Lubricating Blenders

By Elwin E. Hadlick

In setting up the Emergency Price Control Act of 1942, Congress laid down broad rules which would indicate its intentions to the Administrator of the law. When it came to the base period or time at which prices were to be frozen, Congress expressed an intention, but in such a broad way that most anything can be taken from it.

Mr. Hadlick

Congress said, in the original price control act, that "so far as practicable, in establishing any maximum price, the Administrator shall ascertain and *give due consideration* to the prices prevailing between Oct. 1 and Oct. 15, 1941." Of course it said a few more things, and added more qualifications, but those quoted words can certainly be said to be the expression by Congress of its basic intent. There has been no change in the wording of that intent, even though Congress has amended some parts of the law on three different occasions.

So far as petroleum products are concerned, OPA has hit Congress' suggestion right on the nose. With the months that have passed there have been certain specific prices, formulas, etc., promulgated; but basically everything goes back to the Oct. 1 to 15, 1941, period.

That the Administrator did not feel bound by the Congressional suggestion of a base period is evident from what has been done in price control generally. The great majority of price ceiling regulations tie prices back to the highest price charged in March 1942.

Oil Singled Out Early

Petroleum products were one of the early groups to be singled out for administrative control, and the desire of Congress was adopted literally, but not even with the same liberality which was later expressed on commodities generally.

Petroleum products prices were frozen in most instances at the highest price charged on the last sale of the particular product to a customer of the same class during the base period. Contrasted with the general formula, or freezing at the highest price charged during the month of March 1942, the petroleum industry received much more rigid handling from OPA than did any other industry.

Everyone knows that many commodity prices rose from Oct. 1941 to March 1942. Petroleum products prices did not rise, for the simple reason that they were frozen prior to March on the Oct. 1 to 15 basis. Therefore, there is no statistical record to prove that petroleum products prices would have risen from Oct. 1941 to March 1942 in about the same way that other prices went up.

Took Handicap in Stride

The petroleum industry hasn't made as much fuss and commotion about the method of price freezing made applicable to it, as it might have been justified in doing. It has a long history as an industry of going along with burdens placed on it without creating any furore. But there is at least one situation where the October 1941 basing period seems to be unfair.

Two articles were recently carried concerning the OPA approved methods of computing lubricating oil price ceilings.

Prices were frozen on petroleum products at a much earlier date than on other commodities and the whole industry has suffered as a result. Particularly hard hit have been the lubricating oil blenders who must buy their materials well in advance of the time when the finished product reaches the market. Elwin E. Hadlick points out in the accompanying article, his 52nd in the series on war-oil compliance. Mr. Hadlick suggests that it still is not too late to reopen the price question as it applies to this segment of the industry.

It had not been intended to carry the discussion further. Questions and observations made suggest the desirability of at least one more discussion on the subject.

It occurs to some people that OPA treated lubricating oil compounders and blenders in an unfair manner when it set price ceiling formulas applying to products produced by them. It even appears that possibly compounders and blenders have been asleep at the switch when it comes to matters of price ceilings.

This is not saying nor intending to intimate that dealers in lubricating oils have been violating the price ceiling regulations. It is rather to point out the possibility that OPA has used the wrong basis for setting ceilings on lubricating oils. If that be the case those engaged in the business should before now have raised a terrific howl to OPA for a change in base period. It isn't too late even now.

It has been pointed out that petroleum products prices were frozen on an earlier base period than commodity prices generally. Unfair as that might have been to the petroleum industry, the effect is quite different on lubricating oils than it is on refined products. Freezing of prices on refined products on an October 1941 basis would be the freezing of reasonably current sales prices. Buyers do not buy these products, as a rule, on long term commitments or long periods of time in advance of date of use, or if they do, the purchases are on contracts providing for market adjustments. Not so in the case of the ingredients used by lubricating oil compounders and blenders.

Buy Material Far in Advance

A manufacturer of lubricating oils buys his base stocks or ingredients several months in advance of the anticipated date of their moving into the channels of trade as finished products. A survey of several compounders and blenders indicates that it would be conservative to say that ingredients are purchased six months in advance of their moving out as finished products.

Now, if lubricating oil compounders and blenders were manufacturing their finished products in the first half of October 1941 out of ingredients purchased back in April or earlier, were they properly frozen at October 1941 selling levels? There is no way of knowing the answer to this question for the country as a whole other than to make a complete survey. It is a fact, however, that some lubricating oil blenders and compounders were selling finished products in October 1941 at prices which reflected ingredients costs of six months earlier, and that during that same October period replacements of ingredients would have been and were at considerably higher prices than those which prevailed six months earlier.

There are undoubtedly associations which engage in representing the interests of lubricating oil compounders and blenders. There is likely a job here for them. It isn't at all certain from the record that OPA intended to be unfair to these lubricating oil people. It isn't stated as a fact here that they were unfair—it has only been said that the price ceilings are unfair to some.

Survey Should Be Made

A determination should be made whether the pricing and cost situation herein intimated actually existed for compounders and blenders generally. If it is found that the experiences of the few now known are typical of the industry, then someone ought to make a presentation to OPA.

While there would seem to be no reason why OPA couldn't use some base period other than October 1941, the adoption of a different base period at this time may not be practical. That is to say, the adoption of some other base

period may be the adoption of a base for price control which would not reflect market conditions.

It should not be difficult, however, to construct a price base by comparison of ingredient costs for the period in which bought with those existing during the period when ingredients on hand were being used.

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Plan of Procedure for Occupational Deferment of Employes Aged 18-29—Data required by PAW for deferment recommendations.

OPA—Office of Price Administration

GMPR, 2nd RSR 14, Am. 1—Imported pyrethrum flowers' ceiling not governed by 2nd RSR 14.

MPR 88, Am. 25, Official Correction—Tank-car purchaser exception inserted in Oklahoma L.P.G. consumer price.

RMPR 137, Order 2—Ceiling of 5-gal. size Renuzit French dry cleaner.

MPR 453, Am. 6—Wholesale and retail automotive parts ceilings.

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Surplus Property Board

Temp. Reg. A—Disposal of surplus property located outside U. S.

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GO 30, Interp.—Rate range adjustments without NWLB approval.

OIL-LAW-Gram Service

Complete texts of all orders or amendments digested in war-oil orders can be had from Platt's Oil-LAW-Gram, 1213 West 3rd street, Cleveland 13, Ohio. Minimum charge single copies $1. Copies of these texts are always in stock but large orders can be promptly filled by reprinting as plates and stencils are also kept.

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Due care and judgment have been taken in preparing and publishing these digests and in reproducing the original texts but the publisher does not warrant their absolute legal completeness nor accuracy. Important decisions by the reader should be made only after careful study of complete texts.

Digest of Week's War-Oil Orders

Petroleum Administration for War

DATA REQUIRED BY PAW FOR DEFERMENT RECOMMENDATIONS — PAW Plan of Procedure for Occupational Deferment of Employees Aged 18-29—*(Reported at length, with text of forms in full, on pp.* 3 *and* 11-13 *of Feb.* 28 *NPN.)* Issued 2-22.

Office of Price Administration

IMPORTED PYRETHRUM FLOWERS' CEILING NO LONGER GOVERNED BY 2ND RSR 14—GMPR, 2nd RSR 14, Am. 1—Section setting this ceiling deleted from 2nd RSR 14. Issued 2-19, effective 1-29.

TANK CAR PURCHASER EXCEPTION INSERTED IN OKLA. L.P.G. CONSUMER PRICE—MPR 88, Am. 25 Official Corr.—Tank car purchasers are excepted from the 6c delivered ceiling for Oklahoma liquefied petroleum gas consumers in bulk single lots of over 500 gals. Issued 3-5, effective 3-10.

CEILING ON 5-GAL. SIZE RENUZIT FRENCH DRY CLEANER—RMPR 137, Order 2—Retail ceiling on 5-gal. steel pail (pull-out pour spout, removable head and ball) size Renuzit set at $3.35 if 2-gal. size ceiling is $1.09; $3.66 if 2-gal. size is $1.19; $3.85 if $1.25; $3.97 if $1.29; $4.58 if $1.49. Issued 2-23, effective 2-24.

WHOLESALE AND RETAIL AUTOMOTIVE PARTS CEILINGS—MPR 453, Am. 6—Section assigning wholesale and retail ceilings on used parts sets separate price for used transmission differential, motor, or motor subassembly, as distinguished from a "used part". 60% of manufacturer's suggested retail list price new, if usable without rebuilding, is wholesale or retail ceiling; 30% when rebuilding is required. Where such list price is lacking, the ceiling is equal to 42% of the part's components when new, if the part is usable without rebuilding, and 21% if rebuilding is required. If component ceiling is lacking, price for nearest equivalent part, new, is used. The 75% and 30% rule for all other used parts is retained. Issued 2-21, effective 2-26.

CORRECTION OF EFFECTIVE DATE—RO 1A, Official Corr. to Am. 93—Manufacturers are prohibited from transferring new truck tires to dealers without certificate beginning 2-24, rather than 3-2, as first stated. Issued 2-24.

RATIONS FOR INDUSTRIAL PROCESSORS' SUPPLEMENTARY AND EMERGENCY USE—Rev. RO 11, Am. 49—Industrial, commercial, or agricultural equipment rations are not prohibited if the standby facilities are inadequate, but allowable ration will be reduced by amount that can be saved by use of standby facilities at maximum capacity, without consideration of unavailability of labor or alternate fuel. Rations will also be permitted applications made in anticipation of an emergency such as a breakdown, or if PAW has granted applicant a currently valid exception under PDO 13. Applications for rations for emergency use of industrial equipment must be made on OPA Form 1102 (Revised), and amount may not exceed applicant's normal operating requirements for a 10-day period, with amount of fuel oil, ration evidences, and ration credits on hand deducted. Issued 3-3, effective 3-7.

UNIT VALUES FOR COUPONS NUMBERED "5"—Rev. RO 11, Supp. 1, Am. 7—In Zones A-1, B-1, C-1, A-3, B-3, and C-3 value of 1 unit of coupons numbered "5" on Class 4A sheets, of 5 units on 5A sheets, and 25 units on 6A sheets, are fixed at 10, 50, and 250 gals. respectively. Issued 2-26, effective 3-1.

TIME WITHIN WHICH APPEAL MUST BE BROUGHT—Proc. Reg. 9, Am. 15—Appeals to actions taken under ration orders must be received in Board, District or Regional OPA office within 30 days of issuance of notice of action and right of appeal. Issued 3-2, effective 3-6.

War Production Board

DEFERRED ALLOTMENTS—CMP 1, Direction 54 as am. 2-27-45—Producers need not defer a "Z" order if such deferment would stop or interrupt production or operations in a way which would cause substantial loss of total production or delay in operations. Z orders deferred by producers for more than 30 days after quarter in which originally scheduled for delivery, which cannot be scheduled for delivery during succeeding quarter, must be cancelled and removed from producer's production schedule. Rescheduled orders once deferred may not be again deferred but must be cancelled and not rescheduled. Customers must be notified of all such cancellations immediately. Issued 2-27.

CAN MANUFACTURE IN FAR WEST—CMP Reg. 2, Inventory Direction 22—From 3-31-45 through 9-30-45 no user of controlled material may accept delivery in Wash., Ore., Calif., and Utah of tinplate for can manufacture if inventory would thereby become greater than necessary to carry out authorized operations during succeeding 90 days. Issued 2-20.

CONSTRUCTION LIMITATIONS — CMP Reg. 6, Schedule A as am. 2-17-45—Various additions are made to restricted list of construction items, including those made of wood, metal, lead, etc. Compressors, oil-fired equipment and natural-gas-fired equipment, new or used, are among those items which must be listed in project application forms, for approval. Separate application forms are still required, as well as the listing on the project application form, for liquefied petroleum gas equipment, tire retreading, recapping and repair equipment. Issued 2-17.

SPOT AUTHORIZATION FOR PRODUCTION—Pri. Reg. 25 as am. 2-21-45—Pri. Reg. 25 completely revised to clarify distinction between WPB regular, special, and spot authorizations. Applications for spot authorizations must be filed with WPB Field Office on Form WPB-4000, with Form WPB-3820 attached, unless a particular L or M order specifies another form. A spot authorization automatically gives relief from specific provisions of all orders subject to Pri. Reg. 25 with respect to the production authorized. Spot authorizations to produce civilian products do not permit producers to refuse rated orders for civilian or military production, which must still be produced in compliance with all provisions of Pri. Reg. 1. Issued 2-21.

DIRECTION 2 INCORPORATED IN AMENDED PRI. REG. 25—Pri. Reg. 25, Direction 2, Revocation—Issued 2-21.

CURTAILMENT OF NATURAL GAS DELIVERIES TO INDUSTRIAL CONSUMERS—U-7, General Directive 2—From 2-21 to 3-20-45 no utility or non-utility supplier in Appalachian area (Va., West Va., Md., Ohio, Pa., N. Y., D. C.) may make natural gas deliveries to any commercial or industrial consumer having standby facilities capable of

CODE: AO—Administrative Order; CMP—Controlled Materials Plan; D—Directive; FDO—Food Distribution Order; GMPR—General Maximum Price Regulation; GO—General Order; Interp.—Interpretation; L—Limitation Order; M—Conservation Order; MPR—Maximum Price Regulation; P—Preference Rating Order; PAO—Petroleum Administrative Order; Pri. Reg.—Priorities Regulation; Proc. Reg.—Procedural Regulation; PS—Price Schedule; RO—Ration Order; RPS—Revised Price Schedule; SO—Supplementary Order; SR—Supplementary Regulation.

utilizing residual fuel oil, except to extent that such standby facilities cannot supply consumer's fuel requirements. Issued 2-20, effective 2-21, expires 3-20.

PERMITTED CONSTRUCTION OF EXTENSIONS—SO U-1-f as am. 2-27-45—Amended portions refer chiefly to electric extensions, except for requirement that smallest quantities and sizes of equipment, conductor, and pipe required to furnish electric, water, gas, and central steam heat service at minimum standards shall be used in construction of extensions of service under SO U-1-f. Issued 2-27.

Surplus Property Board

DISPOSAL OF SURPLUS PROPERTY LOCATED OUTSIDE U. S.—Temp. Reg. A—Though preliminary and incomplete, Temp. Reg. A is issued to permit foreign disposal operations without delay. Later complete regulations will be issued to supersede this temporary regulation. Foreign disposal, originally assigned to FEA by SWPA Reg. 1, is now (except for FEA property and Lend-Lease surpluses) in hands of Office of Army-Navy Liquidation Commissioner. Foreign sales of plants, pipelines, and other installations costing Government $1,000,000 or more are first to be submitted to Attorney General for an opinion as to anti-trust law applicability, as are also patents, processes, techniques, or inventions, irrespective of cost. The SPB must be informed when negotiations for such disposals are begun. The original act states that the Board and disposal agencies must report to Congress on property costing over $5,000,000, such as plants and facilities for manufacture of synthetic rubber, chemicals, and aviation gasoline, and pipelines and facilities. Transportation facilities may be disposed of without report to Congress. The temporary regulation also permits transportation facilities to be so disposed of. Issued 2-15, filed 2-20.

APPROVAL OF AUTHORITY OF ARMY-NAVY LIQUIDATION COMMISSIONER—Temp. Reg. A, Order 1—Surplus Property Board approves delegation by Army and Navy to Liquidation Commissioner of authority to carry out foreign surplus property disposal under Temp. Reg. A. If Commissioner should use surplus property in settlement of claims the value of the property so used must be paid by Army and Navy into the Treasury, since Board has no authority to settle claims. Issued 2-15, filed 2-20.

National War Labor Board

PAYMENT OF BONUSES, GIFTS, AND COMMISSIONS—GO 10 as am. 2-19-45—Applies only to payment of year-end bonuses by security underwriting, distributing and brokerage companies, exempting them from GO 10's provisions in payment of up to 6% of aggregate annual payroll of employees under NWLB jurisdiction. Issued 2-19, filed 2-26.

RATE RANGE ADJUSTMENTS WITHOUT NWLB APPROVAL—GO 30, Interp.—Any adjustment bringing any part of rate range above 50c hr. requires Board approval. An employer who has the minima of any job classification rate ranges below 50c hr. may hire new employes at rates up to and including 50c without regard to 25% hiring limitation of GO 31. Increases under GO 30 may not be made retroactive to a date earlier than 11-11-44 without prior WLB approval. Issued 2-28.

STAY OF DIRECTIVE ORDER IN DISPUTE CASE—Rules of Proc. as am.—In addition to stay of a wage or salary adjustment directive order permitted upon dissent of two or more public members, is the stay now permitted upon dissent of one public member of an agent which is permitted to function and does in fact function with a quorum of three. Issued 2-15, filed 2-26.

More Initiative Asked in Dist. 2 Crude Hunt

NPN News Bureau

CHICAGO—Move toward more individualism and free enterprise and less leaning on Government crutches was made here last week when the Dist. 2 General Committee "authorized and directed" the chairman of the Crude Oil Supply Subcommittee to inform the industry that after May 1, independent efforts, if any, of refiners in the Midwest who are short of crude for normal operations would be taken into consideration before recommending to PAW that some other refiner or pipeline company divide with them.

"The continuing severity of the crude oil shortage in Dist. 2 and the apparent failure of some refiners to help themselves in securing their own sources of crude," the committee said, "has caused this action."

Full utilization of all types of transportation facilities and right to secure crude under Mid-Continent Crude Compensatory Adjustment Plan No. 5, were suggested. At monthly meetings during the past year, the Crude Oil Supply Subcommittee has emphasized the importance of all refiners on the crude oil supplicant list working out their own private arrangements for crude, and the monthly applications to the subcommittee for help have decreased, but apparently there are some refiners whom the General Committee feels have not done their utmost to help themselves.

The "crude sharing" or supplicant list of refiners given help on their crude supplies for the month of March shows a total of 15,850 b/d as compared with February. The list as approved by PAW follows:

Supplying Co.	Receiving Co.	b/d
Pure Oil Co.	Louisville Ref.	1,000
	Mid-West Ref.	1,150
	Old Dutch Ref.	350
Ohio Oil Co.	National Ref.	2,500
Champlin Ref. Co.	Kanotex Ref.	1,000
Shell Oil Co. Inc.	ElDorado Ref.	2,000
	Kanotex Ref.	250
Standard Oil (Ohio)	Advance Ref.	1,800
	Stoll Oil & Ref.	1,000
Standard Oil (Ind.)	ElDorado Ref. Co.	1,500
	National Ref.	500
Texas Co.	Barsco, Wichita	500
Magnolia	Cascade Ref.	500
Sinclair	National Ref.	500
Louis Rose Ref. Co.	Old Dutch Ref.	100
Producers Ref.	Crystal Ref.	250
	Osceola Ref.	100
Rayburn Pipeline Co.	Crystal Ref.	250
	Marvel Ref.	100
Gulf Ref.	National Ref.	500
		15,850

Boulder Dam Power Line O.K.'d

Special to NPN

LOS ANGELES—Approval to construct a new 130-mile power line from Boulder Dam to Los Angeles and San Diego was given last week to the Southern California Edison Co. in the hope of saving a million bbls. of fuel oil a year.

The project, to cost $4,500,000, was given the green light by the Southern California Area production urgency committee.

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Although each of these Macks has now clocked close to or more than one million miles of work, Mr. G. W. Laurie, Atlantic Refining's automotive transportation manager, reports: "The transmission, rear end, and power drive of these Macks have given remarkable service. Many of the trucks are still operating with original transmissions and differentials. Furthermore, our frame experience has also been most gratifying, and we have yet to experience a frame failure."

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Colorado Plant to Be Built Soon Will Serve As Shale Oil Proving Ground, Ickes Says

NPN News Bureau

WASHINGTON—A plant to serve as a proving ground for processes being developed to convert the nation's large reserves of oil shale into an auxiliary source of fuels and lubricants for the military forces and essential civilian economy is now under way, Secretary of the Interior Harold L. Ickes has announced.

The Bureau of Mines has selected a site on the United States Naval Oil-Shale Reserves in western Colorado for a $1,500,000 demonstration plant, he explained.

The plant is to be established in the Anvil Points area, near the town of Rifle, and will serve as a proving ground for processes being developed to convert oil shale into fuels and lubricants. It will be built on government-owned land and operated in conjunction with an oil shale research and development laboratory which is to be built at Laramie, Wyo., on a site donated to the federal government by the University of Wyoming.

Major features of the Rifle plant will include a 200-ton-a-day shale mine which can be enlarged if necessary, a 1½ mile tramway to carry the shale from the mine to the plant, and crushing and retorting equipment of a capacity adequate to provide useful information on methods of operation and costs for private industry. A shale oil refinery of pilot-plant scale will be added later when technical information needed for its design and construction is obtained by the research and development laboratory.

Bids to Be Asked Soon

Construction of the access roads will begin at once, and invitations for bids on the housing units and office building will be prepared in the near future. Development of the mine and installation of the tramway and retorts will follow. Priorities for the demonstration plant have been cleared through WPB. Architectural and engineering plans for Laramie laboratory have been drawn, manpower requirements approved, and construction waits only the approval of priorities by WPB.

Of the estimated 92 billion barrels of recoverable shale oil in the United States, nearly 48 billion barrels are said to be sealed in the shales around Rifle, considerably more than is scattered in all other states, according to the Bureau of Mines. The shales are both coking and non-coking types and range in richness from 5 to more than 70 gallons of oil per ton.

To produce oil from oil shale, the shale is mined by methods similar to those used in coal mining; crushed, and charged into an oven where heat is applied. This breaks down the organic material and liberates the oil. A ton of high quality shale will yield 45 or more gallons of oil. Products closely resembling those commonly produced from petroleum, such as gasoline, Diesel fuel and waxes, can be made by distilling and refining shale oil.

Returns 13,000,000 Acres of Public Lands to Interior

NPN News Bureau

WASHINGTON—Under an executive order published in today's Federal Register, the way is cleared for eventual return to the departments or agencies of original jurisdiction of control over more than 13,000,000 acres of public lands that have been withdrawn and reserved for military and other Federal war purposes.

Order bears the number 9526, is dated Feb. 28, and provides for the addition of the following paragraph to each of a number of enumerated executive and publis land orders:

"The jurisdiction granted by this order shall cease at the expiration of the six months' period following the termination of the unlimited national emergency declared by Proclamation No. 2487 of May 27, 1941 (55 stat. 1647). Thereupon, jurisdiction over the lands hereby reserved shall be vested in the Department of the Interior, and any other department or agency of the Federal Government according to their respective interests then of record. The lands, however, shall remain withdrawn from appropriation as herein provided until otherwise ordered."

Orders affected are the following: executive orders—

8101, 8102, 8305, 8325, 8343, 8450, 8507, 8508, 8577, 8578, 8579, 8636, 8651, 8652, 8725, 8755 8788, 8789, 8792, 8793, 8794, 8830, 8831, 8847, 8865, 8872, 8874, 8877, 8884, 8892, 8915, 8923, 8927, 8932, 8954, 8957, 8992, 8999, 9000, 9014, 9019, 9020, 9026, 9029, 9042, 9053, 9081, 9086, 9104, 9107, 9109, 9114, 9143, 9215.

Public land order numbers—

1, 3, 4, 6, 7, 9, 10, 11, 13, 15, 16, 18, 21, 22, 24, 25, 26, 27, 28, 31, 33, 34, 35, 37, 39, 40, 43, 44, 50, 51, 55, 56, 57, 58, 59, 60, 62, 63, 64, 66, 72, 74, 75, 76, 80, 81, 83, 85, 87, 88, 89, 90, 93, 94, 97, 98, 105, 109, 110.

Seek New Chief for Inquiry Into Texas Gas Wastage

Special to NPN

AUSTIN, Tex.—The Texas Railroad Commission is casting about for another chairman of its gas wastage investigating committee since the resignation of George Sawtelle of Houston.

Sawtelle, president of the Kirby Petroleum Co. and president of the Houston Chamber of Commerce, told Commissioner Beauford Jester that the press of private business prohibits his serving. He said, however, he would continue in the post until his successor is appointed.

The committee was appointed by the Commission to investigate gas wastage in Texas fields, make recommendations for curbing it, and investigate accuracy of reports on wastage in the oil fields.

Members of the committee include D. V. Carter, Bert Fields, Harry W. Bass, E. H. Blum, Jake Hamon, R. S. McFarland, E. F. Schmidt, John E Pew, R. W. McIlvain, Jr., Charles F. Rosser, D. R. Gearhart, G W. Card, Don D. Harrington, James P. Nash, Al Buchanan, Joe Zeppa, Rogers Lacy, S. Maston Nixon, O. W. Killam, Robert T. Wilson, R. E. Wertz, J. C. Hunter and Arthur Seeligson.

Texas Bill Orders Showdown On Who Owns Oil in Lines

Special to NPN

AUSTIN, Tex. — A bill to force oil pipelines to make sworn statements as to the ownership of all oil in their lines has been passed out by the Texas Senate Affairs Committee.

By Sen. Alvin York, the bill requires the statement be filed with county tax assessors in the counties through which the lines pass by April 1, and shall be a statement of the ownership of the oil as of Jan. 1.

Under present statutes pipeline operators file statements only on the amount of oil they own on Jan. 1. The new measure provides that if a statement of ownership is not filed on the contents of the line, it shall be evidence that such oil is the property of the pipeline and the pipeline shall be taxed for it.

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WHEELING UTILITY CONTAINER

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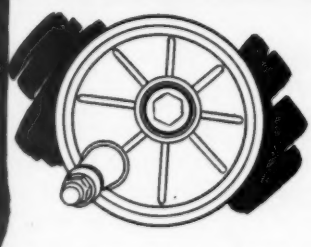
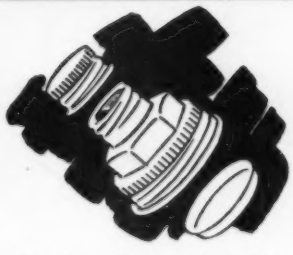
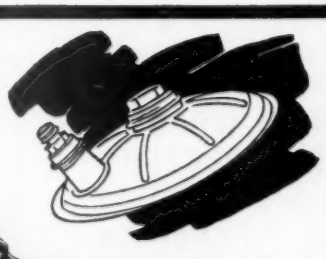


Easy-to-fill. Large, central opening for maximum efficiency in filling operations.



Nozzle and spout designed for refinery sealing. Insures customer getting product as packed. Prevents loss, tampering or contamination.

Years of experience in manufacturing items for farm and home use have aided in the development of this newest leader in the Wheeling Line. Packers are now placing their orders well in advance of their Spring needs and in accordance with order L 197, thereby insuring a place on our manufacturing schedule.



Rib construction of top for strength and to withstand abuse in reuse.

Many reuse possibilities on farm and at home. Nozzle has small opening for pouring light liquids, and larger one for dispensing heavy liquids.

Wheeling CORRUGATING COMPANY

REG. U.S. PAT. OFF.

ARMY E NAVY

WHEELING CORRUGATING COMPANY • WHEELING, WEST VA.

Texas U. Files Suits To End Oil Leases

Special to NPN

AUSTIN, Tex.—The State of Texas has filed suit in district court here to cancel oil and gas leases held by oil companies on 43 tracts of West Texas University of Texas lands.

Recovery of the leases was sought, the petition set out, because of alleged non-development of the lands and the resulting loss to the state in revenue.

The two suits named the Humble Oil & Refining Co. as the principal defendant and leaseholder in 21 tracts in Pecos and Regan Counties, and the Texas Pacific Coal & Oil Co. as the principal leaseholder in 22 tracts in Crockett, Crane, Irion, Schleicher, and Upton Counties.

The suits were filed by the attorney general in behalf of the University of Texas' permanent school fund and asked the court to cancel outright the defendants' leases or, as an alternative, to require immediate drilling on the tracts.

The Humble suit alleged that the lease was given Humble in 1928 after the company had submitted evidence that oil and gas in paying quantities existed in an 80-acre tract in Crane County.

Similarly, the lease was granted the Texas Pacific Coal & Oil Co. and W. B. Powell of Fort Worth on a showing of oil and gas production on a 40-acre tract in Crane County. The state alleges these are the only two tracts now in production.

Leaseholder-defendants listed with Humble in its suit are Mrs. Alice Karnes Evans; Myrtle B. Carter of El Paso County; Tide Water Associated Oil Co. of Houston; Darby Petroleum Corp. of Dallas; Standard Oil Co. of Texas and Sunray Oil Co. of Dallas.

Named co-defendants with Texas Pacific Coal & Oil Co. are W. B. Powell of Tarrant County; P. H. Williams of Tom Green County, and Skelly Oil Co. of Amarillo.

Shell Reports Gas Discovery In California Marshlands

Special to NPN

SAN FRANCISCO — Discovery of what is believed to be an important new gas field in Solano County on the north shore of the marsh lands near Martinez, Calif., was announced last week by the Shell Oil Co.

The discovery well, known as Lambie 1-A, was brought in flowing 2,800,000 cubic ft. of gas daily from a depth of 2,320 ft. A second test resulted in production at the rate of 4,000,000 cubic ft. per day under restricted flow. Full capabilities of the well have not been tested.

A second well is now being drilled half a mile away from the discovery well as the first step to delineate the area of production.

The well was spudded Dec. 15, and two days later had been drilled to 140 ft. where 9⅝-in. casing was cemented in the hold. The final depth of 2,320 ft. was reached Dec. 23.

Oil Fleets Lead Truck Safety Contest at Half-Way Mark

NPN News Bureau

CHICAGO—Two petroleum company fleets have run up the best safety records at the halfway mark in the national fleet safety contest conducted by National Safety Council, it was announced at the council's headquarters here.

Competing against fleets of all types, from taxicabs to intercity trucks, Magnolia Petroleum Co., Dallas, rolled its truck fleet 1,233,000 miles without accident from July 1 to Dec. 31, 1944. The passenger car fleet of Socony-Vacuum's Albany Division, New York, was in second place with a like record for 1,091,000 miles of operation. Also among the leading truck fleets was Shell Pipe Line Corp., Houston.

Atlantic Refining's Atlantic Pipeline Co. fleet was leading in Group 2 with Ajax Pipe Line Corp., Tulsa, having compiled the best safety record in Group 3. Petroleum fleets are leading in five of the eight areas under survey by the council.

Announces Measuring Stations On United's Proposed Line

Special to NPN

SHREVEPORT, La.—R. H. Hargrove, general manager of the United Gas Pipe Line Co., has announced that two measuring stations at Carthage, Tex., and two at Monroe, La., will be installed in connection with the 140-mile, 24-inch pipeline which the company will build between these two points.

No definite route has been announced pending completion of right-of-way work, he said. The project will involve three river crossings—one over the Sabine approximately eight miles east of Carthage; one over the Red River near East Point; and the third at a point approximately nine miles north of Monroe.

Hargrove said construction was planned as soon as approval is obtained from the Federal Power Commission, with the completion date scheduled around Sept. 1. Cost is estimated at $7,000,000.

Denham, China Oil Veteran Joins Arabian American

NPN News Bureau

WASHINGTON — Appointment of H. G. Denham as manager of sales for Arabian American Oil Co., was announced here last week.

Denham, prior to joining California Standard in 1927, was an oil distributor in China for 11 years. In 1943, he rose from assistant manager of Standard's foreign department to president of the California Commercial Co., California Standard subsidiary.

A PUMP YOU CAN TRUST Because

BLACKMER "BUCKET DESIGN" Means

The drawings show you why—

SELF-ADJUSTMENT FOR WEAR... ECONOMY YOU NEVER EXPECTED

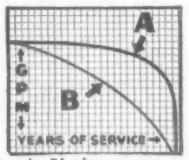
FOR HANDLING

GASOLINE CRUDE OIL	BUTANE FUEL OIL	LUBE OIL NAPHTHA
BULK STATION PUMPS	TRUCK PUMPS	HAND PUMPS
50 to 750 G.P.M.	35-50-90 G.P.M.	1½ to 25 G.P.M.
Single or twin	Double bearings	Barrel or tank

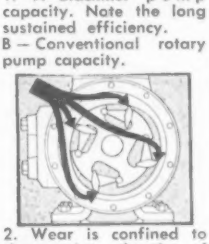
Write for Bulletin No. 102—Pumps for the Petroleum Industry

BLACKMER PUMP COMPANY
1880 Century Avenue Grand Rapids 9, Michigan

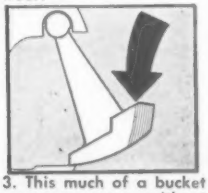
SERVING THE PETROLEUM INDUSTRY FOR 40 YEARS



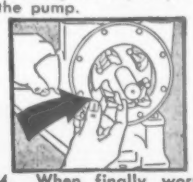
1. A—Blackmer pump capacity. Note the long sustained efficiency. B—Conventional rotary pump capacity.



2. Wear is confined to these points; the tips of the buckets, which automatically compensate for wear.



3. This much of a bucket can wear away without affecting the capacity of the pump.



4. When finally worn out, the buckets are easily replaced (a 20-minute job) and the pump restored to normal capacity.

Financial Reports

SAN FRANCISCO—**The Honolulu Oil Corp.** and subsidiary companies for the nine months ended Sept. 30, 1944, report net earnings after all deductions, including estimated Federal income tax, amounted to $3,285,994.28, or $3.50 per share. This compares with $2,247,039.16, or $2.40 per share in 1943.

° ° °

LOS ANGELES — Officials of the **Superior Oil Co.** of California have reported a net income of $1,443,385 for the three months ended November 30, equal to $3.41 a share on the common stock.

Gross operating income for the 1944 period amounted to $6,282,732, compared with $5,602,788 in the quarter ended November 30, 1943.

° ° °

CLEVELAND — Directors of the **Standard Oil Co. (Ohio)** last month authorized the submission to shareholders at the annual meeting to be held April 2, of a proposal to amend the articles of incorporation of the company so as to split up the outstanding shares of common stock on a 2½ for 1 basis, to increase the number of authorized common shares from 1,300,000 shares to 3,250,000 shares, and to change the par value from $25 to $10 per share.

W. T. Holliday, Sohio president, said that it is expected that if favorable action is taken by the shareholders, the new stock will be placed on a regular annual dividend basis of $1 per share. This would be equivalent to $2.50 per share on the present common stock.

° ° °

PHILADELPHIA—**Sun Oil Co.** and subsidiaries report for the calendar year 1944 consolidated net income of $13,350,217, after setting aside reserves for depreciation, depletion and Federal income taxes.

This compares with a consolidated net income for the year 1943 of $13,353,524.

Net earnings in 1944 equal $4.15 per share on the outstanding shares of common stock as of Dec. 31, 1944, or $4.55 per share on the outstanding shares of common stock prior to the issuance of a 10% stock dividend on Dec. 15, 1944. This compares with $4.56 per share for 1943.

National Refining Announces $180,000 Plant Expansion

NPN News Bureau

CLEVELAND — National Refining Co. will spend approximately $180,000 for additions and improvements to the company's refinery at Findlay, O., in 1945, Louis S. Peirce, vice-president, has announced.

This expenditure, which has been authorized by directors, Mr. Peirce says, is in keeping with the program instituted several years ago of making capital improvements at Findlay as conditions warranted.

Five Tons and It's All His

Each soldier, heading for a fighting front, is supported by five tons of supplies . . . requires one ton per month while overseas.

The Army's Transportation Corps supervises the tremendous task of getting these supplies aboard ship, sending them to overseas ports, distributing them to far-flung battle fronts. One Transportation Corps company traveled 225,000 truck miles in England and France between D-day and the end of June.

Backing up the Army's Transportation Corps on the home front, 24 hours a day and seven days a week, are America's four million commercial motor trucks.

These hard-working, highway haulers are indispensable to the production and transport of virtually every one of the 700,000 different articles of food and fighting equipment required by our millions of overseas soldiers. This is evidenced by the estimates that 75 per cent of today's truck loads are war loads.

In addition to being one of the largest producers of military vehicles, GMC is also building many commercial trucks for essential users. If you are eligible for a new truck, your GMC dealer will gladly help you fill out an application. Remember, too, that GMC is headquarters for the original Preventive Maintenance Service.

INVEST IN VICTORY . . . BUY MORE WAR BONDS

GMC TRUCK & COACH DIVISION
GENERAL MOTORS

HOME OF COMMERCIAL GMC TRUCKS AND GM COACHES . . .
VOLUME PRODUCER OF GMC ARMY TRUCKS AND AMPHIBIAN "DUCKS"

Market Reports

ATLANTIC COAST — No price changes reported. Although milder weather prevailed throughout the week majority suppliers contacted reported demands for home heating oil had not slackened. Transportation was slightly easier.

° ° °

GULF COAST—No price changes. Markets continued unchanged as all supplies continue tight and closely held for regular trade. One refiner reports military taking over most available tank cars in the area.

° ° °

CALIFORNIA—Diesel fuel, solvent, and light distillates continue to be the shortest products here on the coast. Heavy demand is expected to continue for the heating oils due to cold weather. Softest spot seems to be with heavy fuel oil. Housebrand and third grade gasoline are plentiful. Eighty-four service stations reopened on the Pacific Coast during January. The total number of stations still closed on the coast now stands at 4972.

° ° °

MIDCONTINENT — Snow and ice completely halted truck transportation in some areas in the Midcontinent this week. Little improvement was noted in availability of tank cars.

More refiners report calls for third grade gasoline being received. Kansas refiner said he would probably have to start "rationing" regular customers' takings in two weeks. Call for heating oils and kerosine continues heavy, keeping refiners behind on orders. No slackening found in residual demand; several refiners say railroads are asking for more than they can supply.

One car Grade 26-70 natural gasoline reported sold at 4.75c f.o.b. Group 3. No open spot sales were reported f.o.b. Breckenridge; sellers quoted 4.375c during the week.

° ° °

PENNSYLVANIA—No price changes were reported throughout the week. Bright stocks and neutrals continued short with refiners trying to meet both military and civilian requirements. Transportation was reported considerably improved by week's end with transport truck movements practically back to normal.

° ° °

MIDWEST — Prices remain unchanged. Continuing crude shortages for refiners in Michigan and for some others in Dist. 2 is an important factor in the lack of sufficient fuel oils to meet demand, which is still heavy in the northern section of the Middle West. Stocks of kerosine and range oil in Dist. 2 are approximately 200,000 bbls. below a year ago and supply of residual fuel for this month is anticipated to fall below demand by approximately 172,000 bbls.

Inventories of gasoline are up nearly six million barrels over last year, about half of which is earmarked for military. Last to feel the effects of this increase in stocks is Michigan, but most refiners there state the tight gasoline situation, stemming from crude shortage, is also easing off.

N.P.N. Gasoline Index

	Dealer T.W.	Tank Car
	Cents Per Gal.	
March 5	10.37	6.73
Month ago	10.39	6.73
Year ago	10.51	6.83

Dealer index is an average of "undivided" dealer prices, ex-tax, in 50 cities.

Tank car index is weighted average of following wholesale markets for regular-grade gasoline, FOB refineries or terminals: Okla., Mid-Western, W. Penna., Calif., N. Y. Harbor, Philadelphia, Jacksonville, Boston and Gulf Coast.

Daily Av. Pennsylvania Crude Runs

(Compiled by National Petroleum Assn. from reports of all companies refining Pennsylvania crude. Figures in bbls.)

Week Ended Feb. 24, 1945	Week Ended Feb. 17, 1945	Week Ended March 4, 1944
Not available	54,659	58,556

Separate Prices Studied for Oklahoma Diesel Grades

WASHINGTON — Preliminary study is now being given by PAW and OPA to feasibility of setting specific prices for various grades of Diesel oils FOB Oklahoma, which will properly fit in with Mid-Western tank wagon prices. Oklahoma sellers' Diesel ceiling prices are presently on a formula basis.

Before any definite decision is reached, the price agency will consult with the industry and circulate to refiners, jobbers and others affected any price schedule developed.

CRUDE PRICES

Since changes in crude oil prices are so few, the two pages of crude oil price tables hereafter will be printed only when there are sufficient changes in prices to warrant.

In the meantime a record is being kept in the Cleveland office of NPN and OILGRAM from which the publishers will be glad to make proofs or letters or affidavits as to what the prices are, and without charge to regular subscribers. Changes in crude oil prices will be specially noted in this market section when made

Crude Price Changes

No price changes reported for week ending Feb. 28.

For latest table of crude prices published, see NPN, Feb. 28, pages 51, 52 and 48.

Summary of Daily Gasoline Prices (February 26 to March 5)

	Monday March 5	Friday March 2	Thursday March 1	Wednesday Feb. 28	Tuesday Feb. 27
U. S. Motor (ASTM octane)					
76 octane Ethyl:					
Oklahoma	6.75	6.75	6.75	6.75	6.75
Mid-Western (Group 3 basis)	6.75	6.75	6.75	6.75	6.75
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	7	7	7	7	7
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	7 (2)	7 (2)	7 (2)	7 (2)	7 (2)
70-74 octane:					
Oklahoma	5.875	5.875	5.875	5.875	5.875
Mid-Western (Group 3 basis)	5.875	5.875	5.875	5.875	5.875
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.875	5.875	5.875	5.875	5.875
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.875	5.875	5.875	5.875	5.875
63-66 octane:					
Oklahoma	5.625 (1)	5.625 (1)	5.625 (1)	5.625 (1)	5.625 (1)
Mid-Western (Group 3 basis)	5.625 (2)	5.625 (2)	5.625 (2)	5.625 (2)	5.625 (2)
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.625 (1)	5.625 (1)	5.625 (1)	5.625 (1)	5.625 (1)
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.625 (1)	5.625 (1)	5.625 (1)	5.625 (1)	5.625 (1)
60 octane & below:					
Oklahoma	5.25	5.25	5.25	5.25	5.25
Mid-Western (Group 3 basis)	5.2 – 5.25	5.2 – 5.25	5.2 – 5.25	5.2 – 5.25	5.2 – 5.25
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.2 – 5.25	5.2 – 5.25	5.2 – 5.25	5.2 – 5.25	5.2 – 5.25
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.25	5.25	5.25	5.25	5.25
Motor Gasoline, 70-74 oct.					
New York harbor	9.075	9.075	9.075	9.075	9.075
New York harbor, barges	8.975	8.975	8.975	8.975	8.975
Philadelphia district	9.075	9.075	9.075	9.075	9.075
Baltimore district	8.825	8.825	8.825	8.825	8.825
Motor Gasoline:					
Western Penna. Bradford-Warren:					
"Q" Gasoline, Min. 70 Oct. (ASTM)	7.625– 8.225	7.625– 8.225	7.625–8.225	7.625– 8.225	7.625– 8.225
Western Penna. Other Districts:					
"Q" Gasoline, Min. 70 Oct. (ASTM)	7.725	7.725	7.725	7.725	7.725

Note: To conform with Article IV of MPR 88 as amended August 15 we are substituting 70-74 oct. ASTM for the old 72-74 oct. ASTM. We continue to include in this group, Housebrand quotations.

REFINERY OPERATIONS

(American Petroleum Institute figures in thousands of barrels of 42 gal. each. Figures include reported totals plus estimate of unreported amounts and are therefore on a Bureau of Mines basis.)

Districts	Daily Average Crude Runs to Stills Week Ended		Gasoline Production at Refineries inc. Natural Blended Week Ended		Kerosine Production Week Ended		Gas Oil & Dist. Fuel Oil Production Week Ended		Residual Fuel Oil Production Week Ended		Total Stocks Kerosine Week Ended	
	Feb. 24	Feb. 17	Feb. 24	Feb. 17	Feb. 24	Feb. 17	Feb. 24	Feb. 17	Feb. 24	Feb. 17	Feb. 24	Feb. 17
East Coast	698	722	1,933	1,903	225	184	1,003	1,207	1,437	1,664	2,121	2,292
Appalachian (Dist. 1)	101	97	306	295	68	56	62	80	90	116	361	377
Appalachian (Dist. 2)	60	60	177	204	6	21	60	58	88	96	57	41
Ind., Ill., Ky.	819	801	3,086	2,906	310	257	664	718	1,176	1,214	1,564	1,508
Okla., Kans., Mo.	376	392	1,398	1,429	162	160	399	466	524	526	466	512
Inland Texas	246	246	986	1,007	81	100	125	127	466	455	131	134
Texas Gulf Coast	1,173	1,177	3,754	3,606	465	411	1,608	1,293	1,976	2,028	1,221	1,217
Louisiana Gulf Coast	284	251	842	753	238	205	322	336	303	266	910	830
No. La. & Arkansas	82	84	241	226	56	55	60	69	129	126	152	325
Rocky Mt. (Dist. 3)	11	11	36	37	4	4	8	8	23	23	15	15
Rocky Mt. (Dist. 4)	99	103	399	364	23	22	51	67	157	215	100	95
California	854	843	2,342	2,180	77	28	596	624	2,715	2,505	416	416
Total U.S.—B. of M. Basis	4,803	4,787	15,500	14,910	1,715	1,503	4,958	5,053	9,084	9,234	7,514	7,762
U. S.—B. of M. Basis Feb. 26, 1944	4,421		12,824		1,643		4,720		8,825		7,306	

Districts	Total Stocks Gas Oil and Distillates Week Ended		Total Stocks Residual Fuel Oil Week Ended		Gasoline Stocks—Military and Other Week Ended		Gasoline Stocks—Civilian Grade Week Ended	
	Feb. 24	Feb. 17	Feb. 24	Feb. 17	Feb. 24	Feb. 17	Feb. 24	Feb. 17
East Coast	5,469	5,473	4,926	4,903	6,952	7,033	6,397	6,246
Appalachian (Dist. 1)	339	298	228	254	1,324	1,303	1,288	1,403
Appalachian (Dist. 2)	167	195	205	217	612	605	1,026	992
Ind., Ill., Ky.	3,741	4,069	2,336	2,425	6,732	6,624	16,201	15,867
Okla., Kans., Mo.	1,743	1,811	1,174	1,159	1,952	2,088	7,495	6,976
Inland Texas	381	336	656	657	1,198	1,127	1,893	1,901
Texas Gulf Coast	5,418	6,141	8,021	8,198	10,236	10,345	5,600	5,469
Louisiana Gulf Coast	1,859	1,662	1,442	1,460	2,805	2,825	2,315	2,227
N. La. & Arkansas	757	717	271	263	910	927	2,147	1,988
Rocky Mt. (Dist. 3)	15	15	28	28	20	15	66	70
Rocky Mt. (Dist. 4)	315	329	580	626	501	523	1,651	1,521
California	8,549	8,818	26,856	28,050	11,777	12,000	4,874	4,605
Total U.S.—B. of M. Basis	28,753	29,864	46,723	48,240	45,019*	45,415	50,953	49,265
U. S.—B. of M. Basis Feb. 26, 1944	33,889		51,879		35,726		48,666	

*Includes aviation, military, solvents and naphthas and gasoline blending stocks currently indeterminate as to ultimate use; and 12,185,000 barrels of unfinished gasoline this week compared with 11,480,000 barrels a year ago.

Percent Daily Refining Capacity Reporting—East Coast, 100.0; Appalachian (Dist. 1) 83.9, (Dist. 2) 87.2; Ind., Ill., Ky., 85.2; Okla., Kans., Mo., 80.2; Inland Texas, 66.9; Texas Gulf Coast, 90.5; Louisiana Gulf Coast, 95.5; No. Louisiana & Arkansas, 68.0; Rocky Mt. (Dist. 3) 17.0, (Dist. 4) 58.3; California, 89.9; Total U. S.—B. of M. Basis Feb. 24, 1945, 87.2; Total—B. of M. Basis Feb. 17, 1945, 87.2.

U. S. Crude Oil Production

(American Petroleum Institute figures)

	WEEK ENDED Barrels (Daily Average)	
	Feb. 24	Feb. 17
Oklahoma	368,500	366,300
Kansas	272,850	271,350
Nebraska	950	900
Texas	2,146,400	2,146,400
Louisiana	363,600	363,550
Arkansas	82,100	82,200
Mississippi	51,450	51,500
Alabama	250	250
Florida	20	20
Illinois	205,950	204,500
Indiana	12,700	12,500
Eastern (Ill., Ind. & Ky. excluded)	61,250	62,050
Kentucky	32,100	31,100
Michigan	44,500	51,100
Wyoming	100,750	100,950
Montana	19,700	19,700
Colorado	9,450	10,050
New Mexico	103,950	103,950
California	901,500	902,300
Total, U. S.	4,777,970	4,780,670

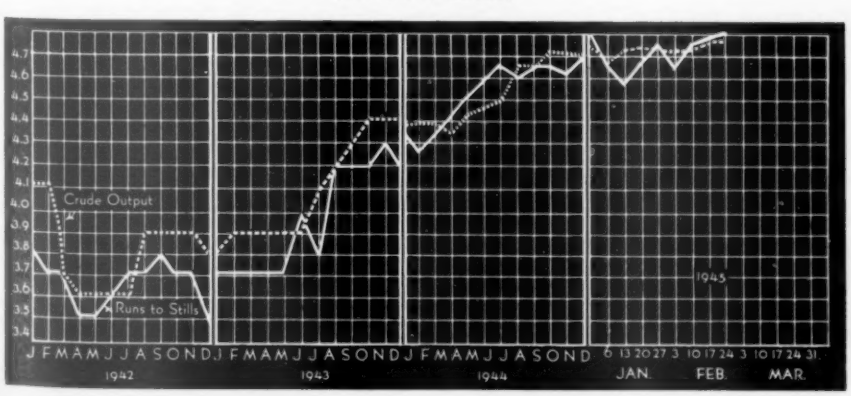
Crude Oil Stocks

(Bureau of Mines Figures in thousands of bbls.)

Grade or Origin	Feb. 17	Feb. 24	Change from Feb. 17
Penna. Grade	2,130	2,155	+ 25
Other Appalachian	1,392	1,367	— 25
Lima-Michigan	964	959	— 5
Illinois-Indiana	14,290	13,837	—453
Arkansas	2,705	2,699	— 6
Kansas	8,691	8,644	— 47
Louisiana	13,277	13,115	—162
Northern	3,314	3,356	+ 42
Gulf Coast	9,963	9,759	—204
Mississippi	1,092	934	—158
New Mexico	6,985	6,856	—129
Oklahoma	30,298	30,417	+119
Texas	110,087	110,323	+236
East Texas	18,325	18,382	+ 57
West Texas	32,121	32,645	+524
Gulf Texas	31,464	31,185	—279
Other Texas	28,177	28,111	— 66
Panhandle	5,433	5,705	+272
North	7,153	7,261	+108
South	5,842	5,825	— 17
Other	9,749	9,320	—429
Rocky Mountain	6,537	6,620	+ 83
California	19,821	19,772	— 49
Foreign	1,791	1,653	—138
Total gasoline-bearing in U. S.	220,060	219,351	—709
Heavy in California	6,038	6,051	+ 13

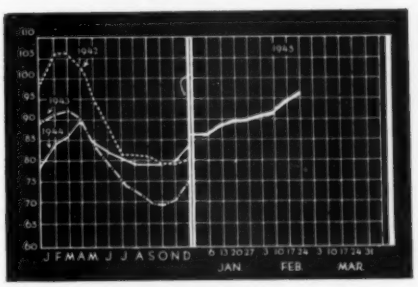
Crude Production & Runs to Stills

(Millions of Barrels)



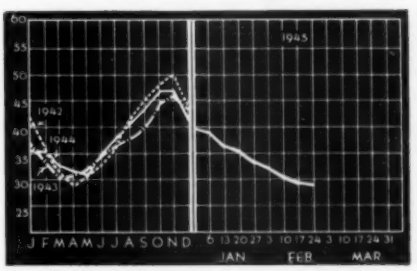
Gasoline Stocks

(Millions of Barrels)



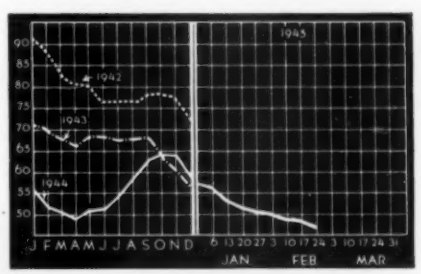
Gas Oil & Distillate Stocks

(Millions of Barrels)



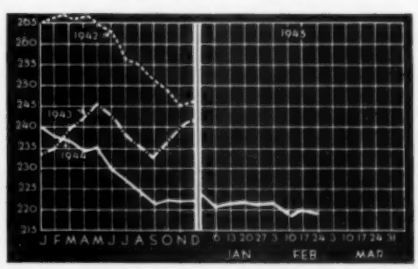
Residual Fuel Oil Stocks

(Millions of Barrels)



Crude Oil Stocks

(Millions of Barrels)



OIL PRICE SECTION ★ At Refineries and Terminals and by Tank Wagon

Prices herewith are reproduced from Platt's *OILGRAM* Daily Oil Price Service, associated with National Petroleum News, whose representatives in all *NPN-OILGRAM* offices devote their time exclusively to reporting oil industry prices everywhere.

Prices shown are actual sales prices, or quotations meaning sellers' general offers or posted prices; for current sales and shipment; for the business day or period stated; except Tank Wagon prices, prices are for bulk lots such as tank car and motor transport; barge or tanker cargo lot prices are identified; FOB refineries or terminals; in cents per gal. except where shown in bbls. of 42 gals.; ex all fees and taxes; for crude oil and its products lawfully produced and transported; reported as received by *OILGRAM* and National Petroleum News but not guaranteed; for subscribers' private use only and not for resale or distribution or publication. For further details of price conditions apply to any *NPN-OILGRAM* office or see back of any *OILGRAM* Price Service invoice.

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Refinery Prices

Gasoline —U. S. Motor (A S T M) except where otherwise specified.

Prices in Effect	March 5	Feb. 26
OKLAHOMA		
76 oct. Ethyl...	6.75	6.75
70-74 oct.....	5.875	5.875
63-66 oct.....	5.625 (1)	5.625 (1)
60 oct. & below.	5.25	5.25
MID-WESTERN (Group 3 basis)		
76 oct. Ethyl...	6.75	6.75
70-74 oct.....	5.875	5.875
63-66 oct.....	5.625 (2)	5.625 (2)
60 oct. & below.	5.2 – 5.25	5.2 – 5.25
N. TEX. (For shpt. to Tex. & N. M. dest'ns.)		
76 oct. Ethyl...	7	7
70-74 oct.....	5.875	5.875
63-66 oct.....	5.625 (1)	5.625 (1)
60 oct. & below.	5.2 – 5.25	5.2 – 5.25
W. TEX. (For shpt. to Tex. & N. M. dest'ns.)		
76 oct. Ethyl...	7 (2)	7 (2)
70-74 oct.....	5.875	5.875
63-66 oct.....	5.625 (1)	5.625 (1)
60 oct. & below.	5.25	5.25
CENT. W. TEX. (Prices to truck transports)		
76 oct.....	7 (2)	7 (2)
70-74 oct.....	5.875 (2)	5.875 (2)
67-69 oct.....	....	....
62 oct. & below.	5.25 (2)	5.25 (2)
KANSAS (For Kansas destinations only)		
76 oct. Ethyl...	7.2 – 7.3	7.2 – 7.3
70-74 oct.....	6.2	6.2
63-66 oct.....	5.9 (2)	5.9 (2)
60 oct. & below.	5.5	5.5
ARK. (For shipment to Ark. & La.)		
76 oct. Ethyl...	7 (1)	7 (1)
70-74 oct.....	5.875 (1)	5.875 (1)
62 oct. "	....	....
60 oct. & below, unleaded.....	5.25 (1)	5.25 (1)
WESTERN PENNA. (Motor gasoline)		
Bradford-Warren:		
"Q" Gasoline Min. 70 Oct. (ASTM)	7.625-8.225(a)	7.625-8.225(a)
Other districts: "Q" Gasoline, Min. 70 Oct. (ASTM)	7.725	7.725

(a) Highs and lows for Schedule D area, in MPR 88 and outside Schedule D area, respectively.

Prices in Effect	March 5	Feb. 26
CENTRAL MICHIGAN (FOB Central Mich. refinery group basis for shpt. within Mich.; shpts. may originate at plants outside Central group.)		
U.S. Motor: (Oct. ASTM):		
70-74 oct.....	7.875– 8.375	7.875– 8.375
75-76 oct.....	9 (1)	9 (1)
Str. run gasoline, excluding Detroit shpt.....	6	6
OHIO (S. O. Ohio quotations for statewide delivery and subject to exceptions for local price disturbances).		
70-74 oct.....	8.25	8.25
CALIFORNIA U.S. Motor:		
76 oct. (Ethyl)...	8 – 8.75	8 – 8.75
70-74 oct.....	7 – 7.5	7 – 7.5
65 oct. & below (3rd grade).....	5.75 – 6.25	5.75 – 6.25

Kerosine, & Gas Fuel Oils

OKLAHOMA		
41-43 grav. w.w...	4.375	4.375
42-44 grav. w.w...	4.5	4.5
Range oil.....	4	4
No. 1 p.w.....	3.875	3.875
No. 1 straw.....	....	....
No. 2 straw.....	3.625	3.625
No. 3 fuel.....	3.5	3.5
No. 6 fuel.....	$0.90-$0.97	$0.90-$0.97
U. G. I. Gas Oil..	....	....
14-16 fuel.....	$0.97 (1)	$0.97 (1)
MID-WESTERN (Group 3 basis)		
41-43 grav. w.w...	4.375	4.375
42-44 grav. w.w...	4.5	4.5
Range Oil.....	4 –4.1 (2)	4 –4.1 (2)
No. 1 p.w.....	3.875	3.875
No. 2 straw.....	3.625	3.625
No. 3.....	....	....
No. 5.....	....	....
No. 6.....	$0.97 (1)	$0.97 (1)
N. TEX. (For shpt. to Tex. & N. M. dest'ns.)		
41-43 grav. w.w...	4.375	4.375
42-44 grav. w.w...	4.5 (1)	4.5 (1)
No. 1 p.w.....	3.875 (1)	3.875 (1)
No. 6 fuel.....	$0.90-$0.97	$0.90-$0.97
W. TEX.		
No. 6 fuel.....	$0.97 (1)	$0.97 (1)
AMARILLO, TEX. (For shpt. to W. Okla. & Tex. differential territory.)		
42-44 grav. w.w...	4.5 (1)	4.5 (1)
KANSAS (For Kansas destinations only).		
41-43 grav. w.w...	No Price	No Price
42-44 grav. w.w...	4.7	4.7
No. 1 p.w.....	4.1	4.1
No. 6 fuel.....	$0.95-$1.02	$0.95-$1.02
ARK. (For shipment to Ark. and La.)		
41-43 grav. w.w...	....	....
42-44 w.w. kero...	4.5 (1)	4.5 (1)
No. 1.....	....	....
No. 2.....	3.625 (1)	3.625 (1)
No. 3 fuel.....	3.5 (1)	3.5 (1)
Tractor fuel, for shpt. to Ark. points only....	5.125 (1)	5.125 (1)
Diesel fuel 52 & below.....	4 (1)	4 (1)
Diesel fuel 58 & above.....	4.25 (1)	4.25 (1)
WESTERN PENNA.		
Bradford-Warren:		
45 grav. w.w.....	6.5 – 7.55	6.5 – 7.55
46 grav. w.w.....	....	....
No. 1 fuel.....	6.55-7.55(2&b)	6.55-7.55(2&b)
No. 2 " ...	6.125-7.125(2&b)	6.125-7.125(2&b)
No. 3 "	6.25-7.25(1&b)	6.25-7.25(1&b)
36-40 gravity.....	6.625-6.75(2)	6.625-6.75(2)

(b) Highs and lows for Schedule D area, in MPR 88 and outside Schedule D area, respectively.

Other districts:		
45 grav. w.w.....	7 – 7.425	7 – 7.425
46 grav. w.w.....	7.125– 7.375	7.125– 7.375
47 grav. w.w.....	7.375– 7.50	7.375– 7.50
No. 1 fuel.....	6.875– 7.175	6.875– 7.175
No. 2 "	6.75 – 6.875	6.75 – 6.875
No. 3 "	6.75	6.75
36-40 grav. Pittsburgh dist. prices excluded.....	6.625– 6.875	6.625– 6.875
CENTRAL MICHIGAN (FOB Central Mich. refinery group basis for shpt. within Mich.; shpts. may originate at plants outside Central group.)		
47-49 gravity w.w.	5.8 – 6	5.8 – 6
P.W. Distillate...	5.5	5.5
No. 3 gas, oil, Straw	5	5
U.G.I. gas oil.....	4.5 (2)	4.5 (2)
Fuel Oils (*Vis. at* 100).		
300-500 Vis.....	4.14 (1)	4.14 (1)
100-300 Vis.....	4.5	4.5
OHIO (S. O. quotations for statewide delivery) Kerosine.....	7	7

Prices in Effect	March 5	Feb. 26
CALIFORNIA		
40-43 grav. w.w...	5 – 7	5 – 7
San Joaquin Valley:		
Heavy fuel.....	$1.10 (2)	$1.10 (2)
Light fuel.....	$1.20 (2)	$1.20 (2)
Diesel fuel.....	4 (2)	4 (2)
Stove dist.....	5 (2)	5 (2)
Los Angeles:		
Heavy fuel.....	$1.10 (2)	$1.10 (2)
Light fuel.....	$1.20 (2)	$1.20 (2)
Diesel fuel.....	4 (2)	4 (2)
Stove dist.....	5 (1)	5 (1)
San Francisco:		
Heavy fuel.....	$1.15 (1)	$1.15 (1)
Light fuel.....	$1.25 (1)	$1.25 (1)
Diesel fuel.....	4.5 (1)	4.5 (1)
Stove dist.....	5.5 (1)	5.5 (1)

NOTE: All above heavy fuels meet Pacific specification 400; light fuel, spec. 300; Diesel fuels, spec. 200; and stove distillate, spec. 100.

Lubricating Oils

Prices in Effect	March 5	Feb. 26
WESTERN PENNA.		
Prices are for sales made, or offers reliably reported, to jobbers & compounders only.		
Viscous Neutrals—*No. 3 col. Vis. at 70°F.*		
200 Vis. (180 at 100°) 420-425 fl.		
0 p.t.....	38 (1)	38 (1)
10 p.t.....	37 (1)	37 (1)
15 p.t.....	36 (1)	36 (1)
25 p.t.....	28-33	28-33
150 Vis. (143 at 100°) 400-405 fl.		
0 p.t.....	36 (1)	36 (1)
10 p.t.....	35 (1)	35 (1)
15 p.t.....	34 (1)	34 (1)
25 p.t.....	26-31	26-31

NOTE: Limited quantity neutrals available to regular trade.

Cylinder Stocks:

Brt. stk., 145-155 *vis. at* 210°, 540-550 fl., *No. 3 col.*		
10 p.t.....	30.5 (1)	30.5 (1)
15 p.t.....	29.5 (1)	29.5 (1)
25 p.t.....	25	25
600 S.R. filterable	15	15
650 S.R.....	15.5	15.5
600 fl.....	16	16
630 fl.....	17	17

MID-CONTINENT (F. o. b. Tulsa)

Neutral Oils (*Vis. at* 100° *F.* 0 *to* 10 *P.P.*)

Pale Oils:		
Vis. Color		
60-85—No. 2....	7.5	7.5
86-110—No. 2...	7.5 – 8.5	7.5 – 8.5
150—No. 3.....	11 –11.5	11 –11.5
180—No. 3.....	11.5 –15	11.5 –15
200—No. 3.....	12 –15	12 –15
250—No. 3.....	14 –16.5	14 –16.5
280—No. 3.....	15 –17	15 –17
300—No. 3.....	16 –18	16 –18
Red Oils:		
180—No. 5.....	11.5 (1)	11.5 (1)
200—No. 5.....	12 (1)	12 (1)
280—No. 5.....	No Price	No Price
300—No. 5.....	16-17.5 (2)	16-17.5 (2)
Bright Stock—*Vis. at* 210°		
200 Vis. D.....	27 (1)	27 (1)
150-160 Vis. D: 0 to 10 p.p.....	23	23
10 to 25 p.p.....	22.5–23	22.5–23
25 to 40 p.p.....	23 (1)	23 (1)
150-160 Vis. E....	22 (1)	22 (1)
120 Vis. D: 0 to 10 p.p.....	22 (2)	22 (2)
600 S.R. Dark Green.....	8.5 (1)	8.5 (1)
600 S.R. Olive Green.....	10-11 (2)	10-11 (2)
631 S.R.....	....	....
Black Oil.....	....	....

NOTE: Discounts of 0.5c to 1c on bright stock and 0.5c to 2c allowed for neutrals, 10 car lots, and to "meet competition." Brokers offering at greater discounts.

SOUTH TEXAS (Neutral Oils)

Pale Oils (*Vis. at* 100°*F.*)		
Vis. Color		
100 No. 1½-2½	6.5	6.5
200 No. 2-3.....	8.75	8.75
300 No. 2-3.....	9.25	9.25
500 No. 2½-3½	10	10
750 No. 3-4.....	10.25	10.25
1200 No. 3-4.....	10.375	10.375
2000 No. 4.....	10.5	10.5

(Continued on next page)

NOTE—Parenthetical figures after prices indicate number of companies quoting when less than three companies are quoting.

NOTICE—Owing to great demand, refiners generally limit quotations to regular customers and refuse bids, though higher, from others. Refiners' prices and sales shown; bids reported in market leads.

Refinery Prices (Continued)

Prices in Effect	March 5	Feb. 26
Red Oils:		
100 No. 5-6	6.5 (2)	6.5 (2)
200 No. 5-6	8.75	8.75
300 No. 5-6	9.25	9.25
500 No. 5-6	10	10
750 No. 5-6	10.25	10.25
1200 No. 5-6	10.375	10.375
2000 No. 5.6	10.5	10.5

CHICAGO (From Mid-Continent p.l. crude.) Neutral oils *vis. at* 100° *F.* 0 *to* 10 *p.p.*

Pale Oils Vis. Color		
60-85—No. 2	9 (1)	9 (1)
86-110—No. 2	9.25 (1)	9.25 (1)
150—No. 3	12.5 (1)	12.5 (1)
180—No. 3	13 (1)	13 (1)
200—No. 3	13 (1)	13 (1)
250—No. 3	14 (1)	14 (1)
Red Oils:		
180—No. 5	13 (1)	13 (1)
200—No. 5	13 (1)	13 (1)
250—No. 5	14 (1)	14 (1)
280—No. 5	15 (1)	15 (1)
300—No. 5	15.5 (1)	15.5 (1)

Note: Viscous oils, 15 to 30 p.p. are quoted 0.5c lower; 60-85 and 86-110 No. 2 non-viscous oils, 15 to 30 p.p., 0.25c lower.

Unfiltered Steam Refined (*Viscosity at* 210°)		
140	11.5 (1)	11.5 (1)
160	12.5 (1)	12.5 (1)
200	13.5 (1)	13.5 (1)
Bright stocks, 160 *vis. at* **210** *No.* **8** *color:*		
0 to 10 p.p.	24 (1)	24 (1)
15 to 25 p.p.	23.5 (1)	23.5 (1)
30 to 40 p.p.	21.5 (1)	21.5 (1)
E filtered Cyl. Stock	15.5 (1)	15.5 (1)

Note: To obtain prices delivered in Chicago add 0.25c per gal.

Natural Gasoline

(Group 3 & Breckenridge prices are to blenders on freight basis shown below. Shipments may originate in any Mid-Continent manufacturing district.)

FOB GROUP 3		
Grade 26-70	4.75 (Sales)	4.75 (Quote)
FOB BRECKENRIDGE		
Grade 26-70	4.375 (Quotes)	4.375 (Quotes)

CALIFORNIA (FOB plants in Los Angeles basin)

21 pound vapor pressure for blending	4.75 - 5.375	4.75 - 5.375

Naphtha and Solvent

(*FOB Group* 3)		
Stoddard solvent	6.625	6.625
Cleaners' naphtha	7.125	7.125
V.M.&P. naphtha	7.1 - 7.125	7.1 - 7.125
Mineral spirits	6.1 - 6.125	6.1 - 6.125
Rubber solvent	7.1 - 7.125	7.1 - 7.125
Lacquer diluent	7.375- 8.125	7.375- 8.125
Benzol Diluent	7.875- 8.625	7.875- 8.625
WESTERN PENNA.		
Other Districts:		
Untreated naphtha	7 -7.25 (2)	7 -7.25 (2)
Stoddard solvent	7.25 -7.5 (2)	7.25 -7.5 (2)

OHIO (S. O. quotations for statewide delivery:)

V.M.&P. naphtha.	D.C. naphtha,	Varnolene &
Sohio solvent	10	10
Rubber solvent	9	9

Wax

WESTERN PENNA. (Bbls. C.L.)

White Crude Scale:		
122-124 A.m.p.	4.25 (2)	4.25 (2)
124-126 A.m.p.	4.25 (2)	4.25 (2)

OKLAHOMA (C.L. FOB Refinery)

Semi-refined:		
128 AMP min., white, 50 kilo bags	No Price	No Price
132-134 AMP, bbls.	5 (1)	5 (1)

CHICAGO (FOB Chicago district refinery of one refiner, in bags, carloads. Carloads, slabs loose, 0.4c less. Melting points are EMP (ASTM) methods; add 3° to convert into AMP.)

Fully refined:		
122-124 (bags only)	5.6	5.6
125-127	6	6
127-129	6.25	6.25
130-132	6.55	6.55
132-134	6.8	6.8
135-137	7.55	7.55

Petrolatums

WESTERN PENNA. (Bbls., carloads; tank cars, 0.5c per lb. less.)

Snow White	6.125- 7.25	6.125- 7.25
Lily White	5.375- 6.25	5.375- 6.25
Cream White	4.375- 5.5	4.375- 5.5
Light Amber	3.375- 4	3.375- 4
Amber	3.125- 3.75	3.125- 3.75
Red	3 - 3.5	3 - 3.5

Tank Wagon Prices

Commercial or consumer tank car, tank wagon, dealer, and service station prices for gasoline **do not include taxes;** *they do, however, include inspection fees as shown in general footnote. Gasoline taxes, shown in separate column, include 1.5c federal, and state taxes; also city and county taxes as indicated in footnotes. Kerosine tank wagon prices also do not include taxes; kerosine taxes where levied are indicated in footnotes. Dealer discounts are shown in footnotes. These prices in effect Mar. 5, 1945 as posted by principal marketing companies at their headquarters offices, but subject to later correction.*

S. O. N. J.

	Esso (*Regular Grade*) Consumer Tank Wagon	Dealer T.W.	Gasoline Taxes	Kerosine T.W.
*Atlantic City, N. J.	10.2	10.7	4.5	10
*Newark, N. J.	10.2	10.7	4.5	10
Annapolis, Md.	10.55	11.05	5.5	....
Baltimore, Md.	9.95	10.45	5.5	10.8
Cumberland, Md.	11.35	11.85	5.5	12.3
Washington, D. C.	10.2	10.7	4.5	11.3
Danville, Va.	11.65	12.15	6.5	12.55
Norfolk, Va.	10.45	10.95	6.5	12.3
Petersburg, Va.	10.75	11.25	6.5	13.3
Richmond, Va.	10.75	11.25	6.5	13.3
Roanoke, Va.	11.95	12.45	6.5	12.8
Charleston, W. Va.	11.65	12.15	6.5	13.1
Parkersburg, W. Va.	10.95	11.45	6.5	12.8
Wheeling, W. Va.	10.95	11.45	6.5	13.4
Charlotte, N. C.	11.70	12.20	7.5	11.3
Hickory, N. C.	12.25	12.75	7.5	12.3
Mt. Airy, N. C.	12.10	12.6	7.5	11.5
Raleigh, N. C.	11.45	11.95	7.5	12.3
Salisbury, N. C.	11.75	12.25	7.5	12.7
Charleston, S. C.	10.55	11.05	7.5	....
Columbia, S. C.	11.40	11.9	7.5	....
Spartanburg, S. C.	12.1	12.6	7.5	....
New Orleans, La.	8.75	9.25	8.5	10.00
Baton Rouge	8.75	9.25	8.5	10.50
Alexandria	8.75	9.25	8.5	10.50
Lake Charles	9.00	9.50	8.5	12.00
Shreveport	8.50	9.00	8.5	9.00
Knoxville, Tenn.	10.50	11.00	8.5	12.50
Memphis	8.90	9.40	8.5	10.50
Chattanooga	10.50	11.00	8.5	11.00
Nashville	10.50	11.00	8.5	10.00
Bristol	10.95	11.45	8.5	13.10
Little Rock, Ark.	9.50	10.00	8.0	10.00

	Mineral Spirits T.W.	V.M.&P. T.W.
Newark, N. J.	13	14.5
Baltimore, Md.	15.5	....
Washington, D. C.	15.5	....

Fuel Oils—T.W.	No. 1	No. 2	No. 3
Atlantic City, N. J.	10	9	9
Newark	10	9	9
Annapolis, Md.	..	..	..
Baltimore	9.8	9	9
Washington, D. C.	10.3	9.4	9.4
Norfolk, Va.	10	8.8	8.8
Petersburg	10.3	9	..
Richmond	10.3	9	9
Charlotte, N. C.	10.3	10.1	..
Hickory, N. C.	..	9.7	..
Raleigh	11.3	9.8	..
Charleston, S. C.	..	8.7	..
Columbia	..	9.7	..
Spartanburg	..	10.5	..

*Effective Aug. 5, '42 minimum retail resale price of 14.2c posted thru New Jersey.

Discounts:

Esso gasoline—to undivided dealers, 0.5c off dealer t.w.

Kerosine—1c off t.w. price for 25 gals. or more, under contract thru territory (Baltimore city contract not necessary) except no discount in state of New Jersey.

Naphtha—To buyers taking following quantities at one time: Newark, 2c per gal. on 200 gals. or more, less than 200 gals. 0.5c higher price; Baltimore, 2c off on 25 to 100 gals. and 3c on over 100 gals.; Washington, 2c off to contract buyers.

Notice

These prices include inspection fees on both gasoline and kerosine unless otherwise specified per gallon as follows:

Ala. 1/40c on gasoline; Ark. 1/20c; Fl. 1/8c; Ill. 3/100c; Ind. 1/5c in lots of 25 bbls. or less, 2/25c in lots of more than 25 bbls.; Kans. 1/50c; La. 1/32c; Minn. 7/200c; Miss. 1/50c; Neb. 3/100c; Nev. 1/20c; N. C. 1/4c; N. Da. 1/20c; Okla. 2/25c; S. Car. 1/8c; S. Da. 1/20c; Tenn. 2/5c; and Wisc. 3/100c.

Kerosine inspection fees only: Ala. 1/2c; Fla. 1/8c; Iowa 3/50c; Mich. 1/5c per gal.

CONT'L OIL

	Conoco Bronz-z-mand (*3rd Grade*) †Tank Wagon	Gasoline Taxes	Kerosine T.W.
Denver, Col.	10	5.5	10
Grand Junc., Col.	12.5	5.5	12.5
Pueblo, Col.	9.5	5.5	9.5
Casper, Wyo.	11.5	5.5	12
Cheyenne, Wyo.	10	5.5	9
Billings, Mont.	12	6.5	12.5
Butte, Mont.	11.5	6.5	13.5
Great Falls, Mont.	12	6.5	12.5
Helena, Mont.	12	6.5	13
Salt Lake City, Utah	13.5	5.5	14.5
Boise, Ida.	13.5	6.5	16.5
Twin Falls, Ida.	14.6	6.5	17
Albuquerque, N. M.	10.5	*7	9.5
Roswell, N. M.	10	*7	7
Santa Fe, N. M.	10.5	*7.5	10
Ft. Smith, Ark.	9	*7	8
Texarkana, Ark.	9	*5.5	7
Muskogee, Okla.	7.75	7	8
Oklahoma City, Okla.	8	7	8
Tulsa, Okla.	8	7	8

*Taxes: In gasoline tax column are included these city taxes—Albuquerque, & Roswell, 0.5c, Santa Fe, 1c. Texas 4c state tax applies within city limits of Texarkana, Ark.; Okla., 5.5c state applies within city limits of Ft. Smith, Ark.

†To consumers & Dealers.

NOTE: Current selling price—where this is lower than maximum price it is because of local competition. It is the actual selling price and is subject to revision due to delays in receiving information from the field.

S. O. CAL.

	Standard Posted Net Tank Truck	Standard Posted Retail	Flight Posted Net Tank Truck	Flight Posted Retail	Gasoline Taxes
	Standard Gasoline (*Regular Grade*) Flight Gasoline (*Third Grade*)				
San Francisco, Cal.	10	14	9	12	4.5
Los Angeles, Cal.	9.5	13.5	8.5	11.5	4.5
Fresno, Cal.	11	15	10	13	4.5
Phoenix, Ariz.	12	16	10	13	6.5
Reno, Nev.	12	16	11	14	5.5
Portland, Ore.	10.5	14.5	9.5	12.5	6.5
Seattle, Wash.	10.5	14.5	9.5	12.5	6.5
Spokane, Wash.	12.5	16.5	11.5	14.5	6.5
Tacoma, Wash.	10.5	14.5	9.5	12.5	6.5

	Std. Aviation 73 Posted Net Tank Truck	Gasoline Taxes	Kerosine Tank Truck
San Francisco, Cal.	12.5	4.5	11.5
Los Angeles, Cal.	12	4.5	10
Fresno, Cal.	13.5	4.5	12.5
Phoenix, Ariz.	14.5	6.5	12.5
Reno, Nev.	14.5	5.5	13.5
Portland, Ore.	13	6.5	13.8
Seattle, Wash.	13	6.5	13.8
Spokane, Wash.	16	6.5	16.8
Tacoma, Wash.	13	6.5	13.8

Resale and Commercial Gasoline: Tank car deliveries of Standard Aviation 73, Standard's Supreme and Flight Gasoline .25c per gal. below posted net tank truck price. Tank car deliveries of Standard Gasoline .375c per gal. below posted net tank truck price. Pearl Oil (The Standard Kerosene) Tank car deliveries 3c below posted tank truck price.

TEXAS CO.

	Gasoline—Dealer T.W. Fire-Chief (Regular)	Indian (*3rd Grade*)	Gasoline Taxes
Dallas, Tex.	7.5	6.5	5.5
Ft. Worth, Tex.	7.5	6.5	5.5
Wichita Falls, Tex.	8.5	7.5	5.5
Amarillo, Tex.	8.5	7.5	5.5
Tyler, Tex.	8.5	7.5	5.5
El Paso, Tex.	11	10.5	5.5
San Angelo, Tex.	8.5	7.5	5.5
Waco, Tex.	8.5*	7*	5.5
Austin, Tex.	8.5	7.5	5.5
Houston, Tex.	8.5	7.5	5.5
San Antonio, Tex.	8.5	7.5	5.5
Port Arthur, Tex.	8.5	7.5	5.5

*Less 1c temporary allowance to all dealers.

(Continued on next page)

Tank Wagon Prices—Continued

S. O. IND.

	Red Crown Blue Crown Red Dealer Prices Crown Cons. T.W.	Red Crown	Blue Crown	Gaso-line Taxes	Kero-sine T.W.
		(*Regular Grade*)	(*Third Grade*)		
Chicago, Ill.	11.6	9.6	9.1	4.5	10.6
Decatur, Ill.	11.6	9.6	8.7	4.5	10.3
Joliet, Ill.	11.9	10.3	9.2	4.5	10.6
Peoria, Ill.	11.7	9.9	9.7	4.5	10.4
Indianapolis, Ind.	11.6	10.1	9.6	5.5	10.1
Evansville, Ind.	11.4	9.9	8.6	5.5	9.9
South Bend, Ind.	12	10.5	10	5.5	10.5
Detroit, Mich.	11.4	9.9	...	4.5	10
Grand Rapids, Mich.	11.4	9.9	...	4.5	9.9
Saginaw, Mich.	11.4	9.9	...	4.5	9.9
Green Bay, Wis.	12.2	10.7	10.2	5.5	10.9
Milwaukee, Wis.	12.1	10.6	10.1	5.5	10.8
La Crosse, Wis.	11.9	10.4	9.9	5.5	10.6
Minneapolis - St. Paul.	11.9	10.4	9.9	5.5	10.6
Duluth, Minn.	12.2	10.7	10.2	5.5	10.9
Mankato, Minn.	11.9	10.4	9.9	5.5	10.6
Des Moines, Ia.	11.4	9.9	9.4	4.5	*10.1
Mason City, Ia.	11.7	10.2	9.7	4.5	*10.4
St. Louis, Mo.	11.0	9.5	9.3	*4.5	10.1
Kansas City, Mo.	11.0	9.5	8.6	*4.5	9.7
St. Joseph, Mo.	11.2	9.7	9.2	*4.5	9.9
Fargo, N. D.	12.9	11.4	10.9	5.5	11.6
Huron, S. D.	12.3	10.8	10.3	5.5	11
Wichita, Kans.	10.3	8.8	7.2	4.5	9.0
Omaha, Neb.	11.4	9.6	9.4	6.5	10.1

	Oleum Spirits	V.M.&P. Naphtha	Stani-sol	*Taxes
	(Prices are base prices before discounts)			
Chicago	13.5	13.8	12.8	4.5
Detroit	15.8	15	16.3	4.5
K. C., Mo.	13.3	14.3	13.8	1.5
St. Louis, Mo.	13.7	14.7	13.2	1.5
Milwaukee	14.4	15.4	14.9	5.5
Minnep'ls	14.2	15.2	13.5	5.5

	Fuel Oils T.W. Chicago	
	Standard Heater Oil	Stanolex Furnace Oil
1-99 gals.	9.3	8.8
100-149 gals.	8.3	7.8
150 gals. & over	7.8	...
150-399 gals.	...	7.8
400 gals. & over	...	7.3

	Stanolex Fuel A	Stanolex Fuel C
1-749 gals.	6.5	6.0
750 gals. & over	5.75	5.25

Stanolex Furnace Oil

Other Points	1-99 gals.	100 gals. & over
Indianapolis	9.0	8.0
Detroit	8.7	7.7
Milwaukee	9.0	8.0
Minneapolis	9.1	8.1
St. Louis	8.4	7.4
Kansas City	8.1	7.1

*Taxes: In gasoline tax column are included these city taxes—Kansas City, St. Joseph and St. Louis, 1c. Iowa kerosine prices are ex 3c state tax. In naphtha tax column are included 1.5c federal tax and state taxes.

State sales, occupation, consumer and use taxes to be added when applicable.

S. O. OHIO

	*Sohio X-70 Gasoline (*Regular Grade*) Con-sumer T.W.	**Re-sel-lers ‡S.S.	Gaso-line Taxes	†Kero-sine T.W.
Ohio, Statewide	12	10	13.5	5.5	9.3
Akron	12	9.5	12.5	5.5	9.3
Canton	12	9.5	12.5	5.5	9.3
Cincinnati	12	9.5	12.5	5.5	9.3
Cleveland	12	9.5	12.5	5.5	9.3
Columbus	12	9.5	12.5	5.5	9.3
Dayton	12	9.5	12.5	5.5	9.3
Lima	12	9.5	12.5	5.5	9.3
Mansfield	12	9.5	12.5	5.5	9.3
Marion	12	9.0	12.0	5.5	9.3
Portsmouth	12	9.5	12.5	5.5	9.3
Toledo	12	9.5	12.5	5.5	9.3
Youngstown	12	9.5	12.5	5.5	9.3
Zanesville	12	9.5	12.5	5.5	9.3

Aviation Gasoline—Statewide

	Consumer Gasoline T.W.	Taxes
Sohio Aviation Gasoline clear	14.5	5.5
Spec. A-N-F-22	14.5	5.5
Esso Ethyl Aviation 73 Oct.	15.5	5.5
Esso Ethyl Aviation 80 Oct.	16.5	5.5
Esso Ethyl Aviation 91 Oct.	17.5	5.5
Esso Ethyl Aviation 100 Oct.	24.5	5.5

	Naphtha—T.W. Statewide	Lucas County
S. R. Solvent	13.5	13.5
D. C. Naphtha	14.5	14.25
V.M.&P. Naphtha	14.5	14.25
Varnolene	14.5	14.25
Sohio Solvent	14.5	14.25

Fuel Oils—T.W.	No. 1	No. 2	No. 3	No. 4
Ohio, Statewide	8.3	8.3	7.8	*7.55

*Renown (third-grade) prices are same as X-70 unless otherwise noted.

**Except authorized agents.

‡Prices at company-operated stations.

††Statewide prices are subject to exceptions other than those shown.

Discounts:

Esso aviation—on contract to hangar operators and resellers, 2c off consumer t.w.

*For Cleveland area only. Full compartment hose dumps.

Fuel oils—Statewide prices are for t.w. & drum deliveries of 50 gals. or more; prices for deliveries of less than 50 gals. are 0.5c higher.

Naphthas—to contract consumers off t.w. prices—Statewide: 300 to 999 gals., 0.5c; 1000 to 2499 gals., 0.75c; 2500 to 4999 gals., 1c; 5000 or more gals., 1.5c. Lucas County: Less than 50 gals., tank wagon price, 50 to 249 gals., 0.5c; 250 to 499 gals., 1c; 500 gals. or over, 1.5c.

ATLANTIC REFINING

	Atlantic White Flash (*Regular Grade*) Commercial T.W.	Dealer T.W.	Gaso-line Taxes	Kero-sine T.W.
Philadelphia, Pa.	10.2	10.7	5.5	12.25
Pittsburgh	10.1	10.6	5.5	12.1
Allentown	10.7	11.2	5.5	12.6
Erie	10.1	10.6	5.5	12.1
Scranton	10.7	11.2	5.5	12.6
Altoona	10.7	11.2	5.5	12.6
Emporium	10.1	10.6	5.5	12.1
Indiana	10.7	11.2	5.5	12.6
Uniontown	10.1	10.6	5.5	12.1
Harrisburg	10.7	11.2	5.5	12.6
Williamsport	10.7	11.2	5.5	12.6
Dover, Del.	....	11.2	5.5	12.6
Wilmington, Del.	....	10.7	5.5	12.1
Boston, Mass.	....	10.9	4.5	....
Springfield, Mass.	....	11.8	4.5	....
Worcester, Mass.	....	11.5	4.5	....
Fall River, Mass.	....	11	4.5	....
Hartford, Conn.	....	11.6	4.5	....
New Haven, Conn.	....	11	4.5	....
Providence, R. I.	....	11	4.5	....
Atlantic City, N. J.	....	10.7	4.5	10
Camden, N. J.	....	10.7	4.5	10
Trenton, N. J.	....	10.7	4.5	10
Annapolis, Md.	....	11.05	5.5	10.8
Baltimore, Md.	....	10.45	5.5	9.8
Hagerstown, Md.	....	11.55	5.5	10.3
Richmond, Va.	....	11.25	6.5	12.3
Wilmington, N. C.	....	11.15	7.5	11.6
Brunswick, Ga.	....	10.1	7.5	10.6
Jacksonville, Fla.	....	10.1	8.5	11.6

	Mineral Spirits T.W.†	V.M.&P. T.W.†
Philadelphia, Pa.	11	12.5
Lancaster, Pa.	12	13.5
Pittsburgh, Pa.	12.5	13.5

	Fuel Oils—T.W. 1	2	3	5	6
Phila., Pa.	10.1	9	9	5.76	5.04
Allentown, Pa.	10.6	9.3	9.3	....	....
Wilmington, Del.	10.1	9	9	....	....
Springfield, Mass.	10.2	9.4	9.4	....	....
Worcester, Mass.	10.2	9.3	9.3	....	....
Hartford, Conn.	10.5	9.2	9.2	....	....

‡Does not include 1c Georgia kerosine tax.

†Mineral Spirits prices also apply to Stoddard Solvent; V.M.&P. prices also apply to Light Cleaners Naphtha.

Discounts:

Gasoline—to undivided dealers, 0.5c off dealer t.w. except Georgia & Florida dealer t.w. and undivided dealer t.w. prices are same.

Kerosine—Thru Penna. & Delaware, 2c off t.w. price on t.w. deliveries of 25 gals. or more at one time.

S. O. KY.

	†Net Crown	Gaso-line Taxes	Kero-sine T.W.
	Crown Gasoline (*Regular*) Standard (*Third Grade*)		
Covington, Ky.	9.5	6.5	9.3
Lexington, Ky.	10.5	6.5	9.3
Louisville, Ky.	10	6.5	8.8
Paducah, Ky.	10	6.5	8.8
Jackson, Miss.	10	7.5	*9
Vicksburg, Miss.	9.5	7.5	*8.5
Birmingham, Ala.	10	*8.5	9
Mobile, Ala.	9	*9.5	8.5
Montgomery, Ala.	10	*9.5	*10
Atlanta, Ga.	11.1	7.5	*11.6
Augusta, Ga.	11.1	7.5	*11.1
Macon, Ga.	11.1	7.5	*11.6
Savannah, Ga.	10.1	7.5	*10.6
Jacksonville, Fla.	10.1	8.5	9.6
Miami, Fla.	10.1	8.5	9.6
Pensacola, Fla.	9	*9.5	8
Tampa, Fla.	10.1	8.5	9.6

*Taxes: In tax column are included these city and county gasoline taxes: Mobile, 2c city; Birmingham, 1c city, Montgomery, 1c city and 1c county; Pensacola, 1c city. Georgia and Montgomery, Ala. have 1c kerosine tax, Mississippi 0.5c, included in above prices.

†Consumer t.w. prices are same as net dealer prices.

HUMBLE OIL

	Humble *Tank Wagon	Thriftane Re-tail	Humble *Tank Wagon	Thriftane Re-tail	Gaso-line Taxes
	Humble Motor Fuel (*Regular Grade*)		(*Third Grade*) Thriftane		
Dallas, Tex.	7.5	10.5	6.5	10.5	5.5
Ft. Worth, Tex.	6.5	9.5	6	7.5	5.5
Houston, Tex.	8.5	12.5	7.5	10.5	5.5
San Ant., Tex.	8.5	12.5	7.5	10.5	5.5

Consumer tank wagon prices are 1c per gal. above the dealer tank wagon prices at Dallas and Ft. Worth.

	Kerosine *Tank Wagon	Retail
Dallas, Tex.	7	10
Ft. Worth, Tex.	7	11
Houston, Tex.	8	11
San Antonio, Tex.	7	10

*To all classes of dealers & consumers.

Canada

PRICES OF IMPERIAL OIL, LTD.

Per Imperial Gallon, which is 1.2 U. S. Gallons

IMPERIAL OIL

	†Gasoline T.W.	*Gasoline Taxes	Kero-sine T.W.
	3-Star Imperial Gasoline (*Regular Grade*)		
Hamilton, Ont.	16.5	11	18
Toronto, Ont.	16.5	11	18
Brandon, Man.	20.5	10	23
Winnipeg, Man.	20.0	10	22.5
Regina, Sask.	17.5	10	20
Saskatoon, Sask.	20.3	10	22.8
Edmonton, Alta.	18.4	10	20.9
Calgary, Alta.	15.5	10	18
Vancouver, B. C.	15	10	24
Montreal, Que.	16.5	11	17.5
St. John, N. B.	16	13	19
Halifax, N. S.	16	13	19

*Includes 3c Federal, and Provincial taxes.

†To divided & undivided dealers.

Absorption Gasoline—No. 26 R.V.P.—$2.28. Gasoline prices effective Oct. 7.

SOCONY VACUUM

	Socony Mobilgas (*Regular Grade*) Com. Cons. T.W.	Undiv. Dlr. T.W.	Gaso-line Taxes
New York City			
Manhattan & Bronx	10.1	10.6	*5.5
Kings & Queens	10.1	10.6	*5.5
Richmond	9.7	10.2	*5.5
Albany, N. Y.	9.9	10.4	5.5
Binghamton, N. Y.	11	11.5	5.5
Buffalo	9.6	10.1	5.5
Jamestown, N. Y.	9.8	10.3	5.5
Mt. Vernon, N. Y.	10.1	10.6	5.5
Plattsburg, N. Y.	11	11.5	5.5
Rochester, N. Y.	10.8	11.3	5.5
Syracuse, N. Y.	10.5	11	5.5
Bridgeport, Conn.	10	10.5	4.5
Danbury, Conn.	10.5	11	4.5
Hartford, Conn.	10.6	11.1	4.5
New Haven, Conn.	10	10.5	4.5
Bangor, Me.	10.7	11.2	5.5
Portland, Me.	10.3	10.8	5.5
Boston, Mass.	9.9	10.4	4.5
Concord, N. H.	11.4	11.9	5.5
Lancaster, N. H.	12	12.5	5.5
Manchester, N. H.	11.3	11.8	5.5
Providence, R. I.	10	10.5	4.5
Burlington, Vt.	10.9	11.4	5.5
Rutland, Vt.	11	11.5	5.5

(Continued on next page)

Seaboard Export Coastwise Prices

Atlantic Coast

(Prices are of refiners, FOB their refineries & their tanker terminals, & of tanker terminal operators FOB their terminals)—Prices in Effect March 5.

MOTOR GASOLINE

District	72 Oct. (ASTM)	70-74 oct. (ASTM)
N. Y. Harb.	Not made	9.075
N. Y. Harb., barges	"	8.975
Albany	"	9.175
Philadelphia	"	9.075
Baltimore	"	8.825
Norfolk	"	8.575
Wilmington, N. C.	"	8.175
Charleston	"	8.175
Savannah	"	7.845
Jacksonville	"	7.845
Miami	"	7.845
Tampa	"	7.845
Pensacola	"	6.875 (1)
Mobile	"	6.62 – 6.745
New Orleans	"	6.125 (1)
Portland	"	9.375
Boston	"	9.275
Providence	"	9.275

FUEL OILS

District	KEROSINE and/or NO. 1 FUEL	No. 2	No. 3	No. 5	No. 6
N. Y. Harb.	7.1	6.7	6.7	$1.85–$1.95(a)	$1.77
N. Y. Harb., barges	7	6.6	6.6 (2)	....	....
Albany	7.3	6.8	6.8 (2)	....	$1.97 (1)
Philadelphia	7.2	6.7	6.7	$1.98	$1.77
Baltimore	7.2	6.7	6.7	$1.85 (1)	$1.77
Norfolk	7.1	6.7	6.7 (1)	$1.85 (1)	$1.77
Wilmington, N. C.	6.75	6.4	....	....	....
Charleston	6.9	6.4 (2)	....	$1.80 (1)	$1.72 (2)
Savannah	6.55	5.75 (1)	....	....	$1.72 (1)
Jacksonville	6.55	5.75	....	....	$1.72
Miami	6.55	5.75 (1)	....	....	....
Tampa	6.55	5.75	....	....	$1.62
Pensacola	4.8 (1)	....	....	....	....
Mobile	4.75 (2)	....	....	....	....
New Orleans	4.125–4.25 (2)	3.75 (2)	....	$1.27 (1)	$0.97
Portland	7.3	6.8	6.8 (2)	....	$1.77
Boston	7.2	6.7	6.7 (2)	$1.95 (2)	$1.77
Providence	7.2	6.7	6.7 (2)	$1.90 (1)	$1.77

(a) Price is for straight-run low pour, test No. 5 ($1.95)

Pacific Export

In Ship's Bunkers, or deep tank lots:

Prices in Effect	March 5	Feb. 26
Diesel Fuel, Pac. Spec. 200	$1.45	$1.45
Grade C fuel, Pac. Spec. 400	$1.10	$1.10

Tank Wagon Prices (Continued)

	Mineral Spirits T.W.	V.M.&P. T.W.
Buffalo, N. Y.	12.4	13.6
New York City	11	12
Rochester, N. Y.	13.2	14.4
Syracuse, N. Y.	14	....
Boston, Mass.	12	13
Bridgeport, Conn.	†16.3	†17.3
Hartford, Conn.	†16.3	†17.3
Providence, R. I.	13	14

	Kerosine Yard	Kerosine T.W.	Mobilfuel Diesel T.C.	Mobilfuel Diesel T.W.	Mobilheat Fuel Yard	Mobilheat Fuel T.W.
New York:						
Manhat'n & Bronx	7.5	10.3	...	9.3	7.1	9
Kings & Queens	7.5	10.3	...	9.3	7.1	9
Richmond	7.5	10.3	...	...	7.1	9.0
Albany	7.5	9.8	6.8	9.3	7	9
Binghamton	8.9	11.2	...	10.7	8.4	10.2
Buffalo	8.1	10.4	7.5	9.8	7.7	9.5
Jamestown	8.2	10.5	...	10.1	7.8	9.5
Mt. Vernon	7.6	10.3	...	9.4	7.2	9
Plattsburg	8.1	10.4	...	9.9	7.6	9.4
Rochester	8.7	11	7.9	10.2	7.9	9.7
Syracuse	8.5	10.8	7.8	10.1	7.8	9.6
Conn.:						
Bridgeport	7.8	10.3	...	....	7.3	9.0
Danbury	8.2	10.8	...	....	7.8	8.5
Hartford	8.0	10.5	...	9.5	7.4	9.2
New Haven	7.5	10.3	...	9.3	7.1	9.0
Maine:						
Bangor	7.9	10.2	7.4	9.7	7.4	9.1
Portland	7.5	10.2	6.8	9.3	7	9
Mass.:						
Boston	7.8	10.6	6.7	9.2	7.1	9
N. H.:						
Concord	8.4	10.7	...	...	8.2	10
Lancaster	9.5	11.8	...	....	9.2	11
Manchester	8.5	11.1	...	....	7.9	9.7
R. I.:						
Providence	7.8	10.1	6.7	9.2	7.1	9.0
Vermont:						
Burlington	8.1	10.4	7.5	9.8	7.5	9.2
Rutland	8.3	10.6	...	10	7.7	9.5

*Does not include 1% city sales tax applicable to price of gasoline (ex tax).
†In steel barrels.
Discounts: Diesel—On t.w. deliveries, 0.5c for at least 400 gals.; 1c for full tank truck.

EXPORT PRICES

Prices Effective March 5

	Mexican Gulf Ports U. S. Dollars per Bbl. Bunker C	Diesel
Tampico	$0.97	$1.65
Veracruz	0.97	....
Coatzacoalcos	0.97	1.65
Pacific Coast		
Guaymas	$1.50	$3.22
Mazatlan	1.50	3.22
Acapulco	1.50	2.89
Manzanillo	1.50	2.89
Salina Cruz	1.50	2.89

	Bunker C Fuel Ships' bunkers (Ex Lighterage)	Diesel Oil Ships' bunkers (Ex Lighterage)	Diesel Oil Shore Plants	Gas House Gas Oil 28-34 Gravity
New Haven	$1.77	....	....	....
N. Y. Harbor	$1.77	$2.78	6.7	6.8 (2)
Albany	$1.97 (1)	$2.94 (1)	6.8 (1)	7 (1)
Philadelphia	$1.77	$2.78	....	....
Baltimore	$1.77	$2.78	6.7 (1)	6.7 (1)
Norfolk	$1.77	$2.78	6.7 (1)	6.7 (1)
Charleston	$1.72 (2)	$2.65 (2)	6.4 (1)	6.4 (1)
Savannah	$1.72 (1)	$2.52 (1)	....	....
Jacksonville	$1.72 (2)	$2.41 (2)	....	....
Tampa	$1.62	$2.41 (2)	....	....
New Orleans	$0.97	$1.65 (1)	4 (1)	....
Portland	$1.77	....	6.8 (1)	6.9 (1)
Boston	$1.77	$2.78 (2)	6.7 (2)	6.8 (2)
Providence	$1.77	$2.78 (2)	6.7 (1)	6.8 (1)

Bunker "C" when from Navy storage at New York and Norfolk to out-going vessels ships .05c discount. (Subject to cancellation.)

Gulf Coast

Prices in Effect March 5

MOTOR GASOLINE	New Orleans & Lower Mississippi to Baton Rouge Tank Cars	New Orleans & Lower Mississippi to Baton Rouge Barges	Texas Gulf Coast South of New Orleans Tank Cars	Texas Gulf Coast South of New Orleans Barges	CARGOES Domestic & Export From all Gulf Ports
Leaded (oct. by ASTM)					
76 oct.	6.75	6.5	6.75	6.75	6.75
70-74 oct.	6 – 6.125	5.625	5.625–6.375 (a)	5.625	5.625
63-65 oct.	....	....	....	....	....
Unleaded 70 oct.	....	....	....	....	5.625
67-68 oct.	....	....	....	....	....
65 oct.	....	....	....	....	5.25
60 oct.	....	....	....	....	5
KEROSINE & LIGHT FUELS					
41-43 w.w. kero.	4.125– 4.25	4.125	4.125– 4.25	4.125	4.125
42-44 w.w. kero.	....	....	4.125	4.125	4.125
No. 2 fuel oil	3.75	3.75	3.75 – 4	3.75	3.75
DIESEL & GAS OILS					
(In diesel index No.)					
Below 43 di.	....	....	....	....	....
43-47 di.	....	....	....	....	4
48-52 di.	4	4	4	....	4
53-57 di.	4.125	....	4.125	4.125	4.125
58 and above	4.25	....	4.25	....	4.25

(a) 5.625c for Dist. 1 and 6.125-6.375c for other districts.
NOTE: Above products in Truck Transports of 2,400 gal. and over ½c above Tank Car Prices.

Heavy Fuels & Bunker Oil (at all Gulf Ports) Heavy Diesels	In Cargoes	In Ship's Bunkers (Ex Lighterage)
Below 28 API Grav.	....	$1.35
28 & above API Grav.	....	$1.65
Bunker C Oil	$0.97	$0.97

Mid-Continent Lubes

(At Gulf; in packages, FAS.; in bulk, FOB terminals).

Prices in Effect March 5

	Steel Drums	Bulk
Bright Stock		
D color, Vis at 210°		
200 vis.	....	....
150 vis., 0-10 p.p.	32.65 (1&a)	24.8 (1)
100 vis., 0-10 p.p.	....	....
100 vis., 10-25 p.p.	....	....
Neutral—No. 3 color		
200 vis., 0-10 p.p.	....	....

(A) FAS at New Orleans.

Wax

(Melting points are AMP, 3° higher than EMP) Prices are FOB refinery and do not include bag; freight or export differentials).

Prices in Effect March 5

Crude Scale	New Orleans Export	N. Y. Domestic	N. Y. Export
124-6 Yellow	4.25 (1)	....	4.25 (1)
122-4 White	....	4.25 (2)	4.25 (2)
124-6 White	4.25 (1)	4.25	4.25
Fully Refined:			
123-5	5.2 (1)	5.2 (2)	5.2 (1)
125-7	5.2 (1)	5.2 (2)	5.2 (1)
128-30	5.6 (1)	5.6	5.6 (1)
130-32	5.85 (1)	5.85 (2)	5.85 (1)
133-5	6.15 (1)	6.15	6.15 (1)
135-7	6.4 (1)	6.4 (1)	6.4 (1)

Naphtha

Prices in Effect March 5

	V.M.&P. Naphtha	Mineral Spirits
New York Harbor	11 (2)	10
Philadelphia	11 (2)	10
Baltimore	10.5 (2)	9.5
Boston	11.5 (2)	10.5
Providence	11.5 (1)	10.5 (2)

CLASSIFIED

For Sale

SERVICE STATION AND BULK PLANT

Good modern station—fully equipped—wash and grease room—42,000 gallon storage—building—pumps—tank car and transport unloading—doing good business—in Kansas farm community.

Box No. 540
National Petroleum News

FOR SALE

2 Gasoline Truck Meters, minimum capacity 12, maximum capacity 100 GPM.
1 Steel Building 30′ x 100′ x 22′.

Empire Equipment Corporation
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Phone: Main 7667

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Available for consultation on OPA Price Regulations.
Available to set up petroleum price records in accordance with OPA Regulations.

PETROLEUM PRICE SERVICE
508 Hippodrome Bldg., Cleveland, Ohio
Phone: Cherry 2262

ANTI-KNOCK VALUES DETERMINATORS
The Gray Industrial Laboratories
Chemists and Engineers
Specialists on Petroleum Products
961-976 Frelinghuysen Ave., NEWARK, N. J.
Telephone Bigelow 3-4020

Positions Wanted

WANTED: Position by man with fourteen years of experience in Sales and Operations. Draft exempt. Prefer southern Ohio or deep south. Box No. 539.

MANAGER Liquefied Petroleum Gas Department. Fifteen years experience in Gas Sales, engineering, and conversion of Industrial, utility plants. Graduate Engineer. Age 40. Box No. 541.

Situations Open

EXCELLENT OPPORTUNITY is available with a mid-western refiner for man experienced in tank car selling. Reply Box No. 534.

CHIEF ENGINEER

To supervise engineering, design estimating and processing of oilfield equipment, welding, and grey iron foundry work. Plant employs 150 people in community of 25,000 in central Ohio. State complete details on experience, education, age, marital status, draft status, and salary expected. Reply to—

Box No. 543

WANTED

MERCHANDISING MANAGER PETROLEUM PRODUCTS AND AUTOMOTIVE ACCESSORIES

Rapidly expanding, fully integrated oil company needs a man with ideas, imagination and experience in marketing petroleum products and automotive accessories. This opening will challenge the best efforts of a top notch man with energy and ambition. The job is new, the possibilities great and the man selected will have the opportunity of building his own future. Send full details. Formal application will be promptly mailed.

Box No. 532

Situations Open

WANTED: EXPERIENCED REFINERY SUPERINTENDENT for Gulf Coast refinery. Preferably chemical engineering background with Dubbs or Kellogg cracking plant experience. In application state age, experience, education, training, salary expected, when available. Statement of availability required. All replies confidential. Box No. 531, National Petroleum News.

WANTED

Large independent Chicago distributor of petroleum products through its own stations offers an unusual opportunity for man of proven successful experience, capable of complete field supervision and management of sales of petroleum and automotive products. Give full details.

Box No. 600
59 E. Van Buren, Chicago, Ill.

Ashland Oil & Refining Company,
Ashland, Kentucky,

WANTS
DESIGNING DRAFTSMAN

With experience in oil refinery and power plant piping, pressure vessels and heat exchangers. Independent company with completely integrated operations and a large output of 100 octane gasoline. Due to postwar program this position offers excellent opportunities for the future.

Address all correspondence to Employment Department. Applicants must comply with War Manpower Commission Regulations.

PRODUCTION MANAGER

A man with practical experience and a proven performance record to operate the Production Function of well established firm manufacturing oilfield equipment, glass house castings, and miscellaneous welding work. He must be able to fit into established organization and will be given complete authority over his function. Plant employs 150 people in community of 25,000 in central Ohio. State complete details on experience, education, age and salary expected. Reply to—

Box No. 544

MEN FOR FOREIGN EMPLOYMENT
In Saudi Arabia

Refinery operators; petroleum, electrical and mechanical engineers; radio operators and technicians; Diesel and tractor mechanics; air-conditioning and refrigeration mechanics; stabilizer operators; utility operators; surveyors; boilermakers, pipefitters, and various other crafts; accountants; stenographers; typists.

Employment offers opportunities for postwar security and advancement. Liberal benefit plans; vacations in United States; free hospital and medical care.

If genuinely interested in foreign career, send full information on experience, transcript of college record (professional applicants only), references, draft and availability status to our Employee Relations Department.

ARABIAN AMERICAN OIL COMPANY
200 Bush Street
San Francisco 4, California

National Petroleum News

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Wanted to Buy

WANTED

Tractor and trailer to haul gasoline and oil. Capacity 4200 to 4600 gallons. Must have at least 450 cubic inch motor in tractor.

Quote condition and lowest cash price.

Parmelee Motor Fuel Company
118 South First St., Pittsburgh 19, Pa.

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NAVY'S OIL DEPOT

(*Continued from p.* 16)

and through an intricate network of pipelines, to the vast underground vaults in San Pedro.

Uncle Sam's production partner in the Elk Hills project in taking the crude from the ground is the Standard Oil Co. of California. The refining of this crude into suitable products for ships, tanks, planes, and the many other types of motorized war equipment and vehicles, is handled by a number of California refiners.

In explaining the vital part which oil men are playing in the successful operation of this fuel depot, Commander Coltman explained that many of the facilities used here were lent to the Navy by the oil companies.

Too much praise cannot be given to the co-operating oil men, the commander said, stating that the successful operation is attributable, in a large part, to the oil industry itself.

Commander Coltman, who directs the activities at the Naval Fuel Annex, spent all his life, except for his four college years, in North China, where he worked for the Standard-Vacuum Oil Co.

Quits DSC Post to Be Adviser Of Cities Service President

Special to NPN

NEW YORK—Appointment of George H. Hill, Jr., as vice-president of Petroleum Advisers, Inc., was announced this week by W. Alton Jones, president of Cities Service Co.

Petroleum Advisers is a management and technical unit co-ordinating the activities of Cities Service's petroleum operating committees. Mr. Hill will leave the post of executive vice-president and general counsel of Defense Supplies Corp. which he has held since 1942.

The Cities Service announcement said: "Mr. Hill will assist the president of Cities Service in connection with the company's work of supplying the government with war materials such as 100-octane gasoline, butadiene, special lubricants and ordnance.

"He will also aid Mr. Jones in carrying on the war activities in which he is engaged as president of War Emergency Pipelines, Inc., and in various posts in PAW and P.I.W.C. Mr. Hill will also devote time to the company's program of postwar rehabilitation and extension of plants."

Texaco Experiments Develop Jet-Plane Fuel and Lubes

NPN News Bureau

NEW YORK — The Texas Co. announced last week that it has developed special fuels and lubricants for turbo-jet engines, motive power of jet-propelled fighter aircraft. The announcement was made in conjunction with the release of details on the engine itself.

Some unusual problems were encountered in fueling and lubricating the jet engine, The Texas Co. said. Fuel requirements differ considerably from those of the conventional aircraft engine or the Diesel engine. The fuel is a very narrow petroleum "cut," between kerosine and gasoline in its nature.

The lubricant must perform satisfactorily under severe temperature extremes. It must flow freely at 80-90 degrees below zero Fahrenheit and must still retain its lubricating properties and not break down in high-speed bearings at 250 degrees and above. Fuels and lubricants developed by Texaco are now being subjected to extensive tests in army jet planes.

Gulf Oil Corp. Employes Get $375,000 Bonus

Special to NPN

PORT ARTHUR, Tex.—Gulf Oil Corp. employes here drew an extra $375,000 in their pay checks the last week in February as a belated Christmas present.

The sum was the annual bonus, equal to two weeks' pay at straight time. Workers who entered the armed services in 1944 were paid an amount based on the part of 1944 they worked for the company.

Butane Gas License Proposal Is Sidetracked in Texas

Special to NPN

AUSTIN, Tex.—A bill to license butane gas and appliance dealers received a setback when the House state affairs committee refused to report it out and sent it back to the subcommittee for further study.

By Rep. Roger Evans, the bill would require gas dealers to follow safety rules set out by the Railroad Commission and charge all dealers a $50 annual fee. Objections were made that the bill was too stringent.

Fuel Index 73% to 81%

CHICAGO — OPA weekly fuel index shows that not more than 75% of yearly allotments of fuel oil should have been consumed up to March 5 in the metropolitan Chicago area. Index for other cities follows: Detroit, and Bismarck, N. D., 75%; Indianapolis and Des Moines, 78%; Cincinnati and Omaha, 79%; Wichita, Kans., 80%; St. Louis, 81%; Milwaukee, 73%; Minneapolis and Pierre, S. D., 76%.

Editor Joins Dist. 1 Staff

NEW YORK—William C. Daffron has been appointed assistant to Charles L. Harding, director-in-charge of PAW Dist. 1. Mr. Daffron succeeds Charles S. Allen, now in the Army.

A veteran newspaper and magazine editor and correspondent, Mr. Daffron has been a member of PAW's Washington public relations staff for the last year.

DEATHS

Joseph L. Walsh

CLEVELAND — Joseph L. Walsh, formerly vice president in charge of sales for Jesco Lubricants Co., Kansas City, Mo., died suddenly last week at his home in Cleveland. He was 70.

Mr. Walsh

Mr. Walsh spent his lifetime in the oil industry, his first position being with the old Schofield, Schurmer and Teagle Oil Co. of Cleveland. He was later sales manager for the Great Western Oil Co., also of Cleveland, and then became manager of refinery sales with Continental Oil Co. in Denver.

In 1930 he resigned the presidency of the Home Oil & Supply Co., Denver, to become director of sales with Jesco. He remained with Jesco until his retirement two years ago.

Mr. Walsh was a director of the Western Petroleum Refiners Assn. for a number of years, and was one of the founders and an honorary life member of the Kansas City Oil Men's club.

Harry P. Powell

FORT WORTH, TEX. — Funeral services were held here Feb. 28 for Harry P. Powell, 60, vice-president of the Mid-Continent Oil Well Supply Co., who died Feb. 26. Mr. Powell had been in ill health for several years following an accident in West Texas.

Mr. Powell had been a resident of Fort Worth for 30 years and was widely known among Southwestern oil men.

Frank L. Hadley

PHILADELPHIA—Frank L. Hadley, vice president of the Susquehanna Pipe Line Co., died here on Feb. 27. He was 65.

Mr. Hadley, who had been associated with the Susquehanna company since 1922, obtained his first job as ditch digger in the oil fields of Bradford, Pa. He worked for Standard Oil Co. of New Jersey for 21 years and supervised the construction of some of the nation's largest pipelines. Later, he was employed with the People's Natural Gas Co. of Pittsburgh and the Union Oil Co. of Delaware.

He is survived by his wife and one son, who is an electrical engineer with the Susquehanna Pipe Line Co.

Coming Meetings

APRIL

Independent Petroleum Assn., mid-year meeting of the Board of Directors, New Orleans, La., April 9-10-11.

OCTOBER

Indiana Independent Petroleum Assn., fall convention, Hotel Severin, Indianapolis, Oct. 10-11.

ABOUT OIL PEOPLE

"Structure of South Louisiana Deep Seated Salt Domes" was the topic of **W. E. Wallace** of the Standard Oil Co. (Ohio) of Shreveport before the Houston Geological Society. The paper which he discussed was recently published in the bulletin of the American Assn. of Petroleum Geologists.

° ° °

Reorganization of Creole Petroleum Corp. was completed last week when the board of directors elected **Arthur T. Proudfit** as president and **Horry F. Prioleau** as executive vice president.

Mr. Prioleau

Mr. Proudfit, who had been a vice president and general manager of the company's Venezuelan operations, succeeds **C. H. Lieb**, who died on Dec. 30, 1944. He will continue as general manager with his office in Caracas. Mr. Proudfit will be Creole's chief executive officer in New York. He has been a vice president and is a director of the company.

Creole is not only the leading producer of Venezuelan oil but it also has two refineries in that country. Formerly a holding company, it absorbed the properties of the Standard Oil Co. of Venezuela and purchased the Venezuelan properties of Lago Petroleum Corp. in August, 1943, thus becoming a direct operating corporation. It is an affiliate of Standard Oil Co. (New Jersey).

Both Mr. Proudfit and Mr. Prioleau have had more than 20 years' experience in the oil industry, principally in foreign fields. Mr. Proudfit was employed in 1919 as a drilling tool dresser for Huasteca Petroleum Co. in its Tampico, Mexico, properties. Mr. Prioleau began work as a laboratory assistant in the Charleston, S. C. refinery of the Standard Oil Co. of New Jersey in 1921.

When Mr. Proudfit left Mexico in 1927, he was in charge of all drilling operations of Huasteca. He became assistant superintendent of operations in the Lake Maracaibo fields in Venezuela. In January, 1936, he became manager of the New York division of Standard Oil Co. of Argentina and two years later, he returned to Venezuela as assistant manager of Standard Oil Co. of Venezuela.

In 1942, Mr. Proudfit was elected president of Standard of Venezuela and when that company and Lago were consolidated with Creole in 1943, he became a vice president of Creole and general manager of all operationss in Venezuela.

Mr. Prioleau came to New York as assistant to the general manager of the Charleston, S. C., Standard Oil refinery. His work was later extended to include Latin America and other foreign refineries.

In 1929, he went to The Hague as head of the refinery department of N. V. Nederlandsche Koloniale Petroleum Mij., a Jersey Standard affiliate. In 1934, he became general manager of NKPM and continued in that post until forced to leave the Netherlands in 1940 by the German invasion. After his return to New York, Mr. Prioleau worked for various foreign operating units of the Jersey Standard group. In 1943, he joined the staff of Creole as an assistant to the president. He was elected a vice president in July, 1944, and became a director one month later.

° ° °

Ill for the past several weeks, **DeWitt Knox**, treasurer of Macmillan Petroleum Corp., is reported improving in Los Angeles.

° ° °

Charles S. Stoddard, power plant operator at the Shell Oil Company's Wilmington, Calif. refinery, has received word that his son, Kenneth, is missing in action in the South Pacific.

° ° °

Dr. Breth

Mr. Schindler

Dr. F. W. Breth and **Gustave Schindler** have been elected vice presidents of L. Sonneborn Sons, Inc., oil refiners and manufacturers, it was announced in New York last week by **Dr. Ferdinand Sonneborn**, president.

Dr. Breth, who will serve as vice president in charge of manufacturing, joined the company in 1915 as chief chemist and was later appointed technical director. His work included extensive research in the crystallization of paraffin waxes.

Mr. Schindler has operated a group of refineries which manufactured many specialized petroleum products similar to those made by Sonneborn.

Those products were pioneered in England, Europe, Africa, South America, and the Far East. Later Mr. Schindler became president of Petroleum Specialties, Inc., which he founded in 1939. He will continue in that post while he is with Sonneborn, where he will probably specialize in export operations.

Russell Palmer, public relations chief at the Los Angeles PAW, is back in Los Angeles following a business trip to Washington.

° ° °

Dr. Frank M. Surface has been named executive assistant to the president of Standard Oil Co. (New Jersey) it was announced this week by **Eugene Holman**, company president.

Dr. Surface

Dr. Surface has been co-ordinator of sales research for Jersey Standard since 1943. Before that he was director of sales research for 10 years for the domestic operating subsidiary, Standard Oil Co. of New Jersey. He is an authority on economics and the author of many articles and books on the subject. From 1927 to 1933, he was assistant director of the Bureau of Foreign and Domestic Commerce in the Department of Commerce.

Dr. Surface attended both Ohio State University and the University of Pennsylvania, where he received his doctorate. After studying biological research work at various universities, he became assistant chief of the statistical division of the U. S. Food Administration during World War I. He served as food statistician with the American Peace Commission in Paris after the war and as chief statistician for the American Relief Administration in Europe.

° ° °

Kenneth A. Aid, chief geologist of Barnsdall South American Corp., left Tulsa recently on a several weeks' business trip to Caracas, Venezuela.

° ° °

J. Lloyd O'Donnell, nephew of **Thomas A. O'Donnell**, well known California oil pioneer who died last week following a heart attack, will keep the name of O'Donnell in the oil industry. He resides in Long Beach, Calif.

° ° °

Milton N. Weir has been named assistant to **W. V. Hartmann**, vice president in charge of sales of the Gulf Oil Corp.

Mr. Weir

Mr. Weir was formerly assistant division manager of the New York division of Gulf in which he will be succeeded by **E. D. Rohrback**.

Mr. Weir's offices will be located at 120 Broadway.

Twelve years ago, this pair of M & S gasoline pumps first saw the light of day. And now, twelve years later, each pump is still on the job in spite of wartime shortages of parts and replacements.

The working-parts inside a pump determine its serviceability. Practical designing and accurate production can add years of trouble-free service. This has been proved time and time again by M & S service-records.

Performance like this is really worth considering when new pumps are again available. Then you'll find M & S pumps even more serviceable than their pre-war cousins — thanks to things learned in turning out accurate machining for the Army and Navy. They'll have smart looking exteriors, in keeping with the stations of tomorrow. And they will offer new and practical features to increase sales and speed service.

LOOK TO M&S FOR THE PUMPS OF TOMORROW

MARTIN & SCHWARTZ

SALISBURY, MARYLAND

pumps

FLEET-WING PRODUCTS

..the Jobber Brand

NOAH WEBSTER SAYS:

JOBBER: "One who buys goods from producers and sells to other dealers."

THAT phrasing leaves a lot lacking in defining the jobber of today—especially a Modern "Oil" Jobber!

Today's jobber—and certainly the Jobber of Tomorrow—MUST DO MORE THAN BUY AND RESELL.

—He must be capable of counseling and advising his dealers on the problems of station management and retail merchandising.

—He must expand services and facilities to meet changing conditions.

—He must initiate profitable marketing practices . . . know promotion, merchandising, personnel relations and sales training.

Because successful Independent Jobbers must function in all these things that Mr. Webster didn't take into account, Fleet-Wing Corporation is vitally interested in them too. That's why Fleet-Wing's program of individualized advertising and sales promotion is so valuable—*now, and in the future.*

Because we can serve you in all these ways—as we do others—we invite you to write about the availability of a Fleet-Wing distributorship in your territory.

FLEET-WING CORPORATION

1025 REPUBLIC BUILDING, CLEVELAND, OHIO

TECHNOLOGY DEPT.

NATIONAL PETROLEUM NEWS

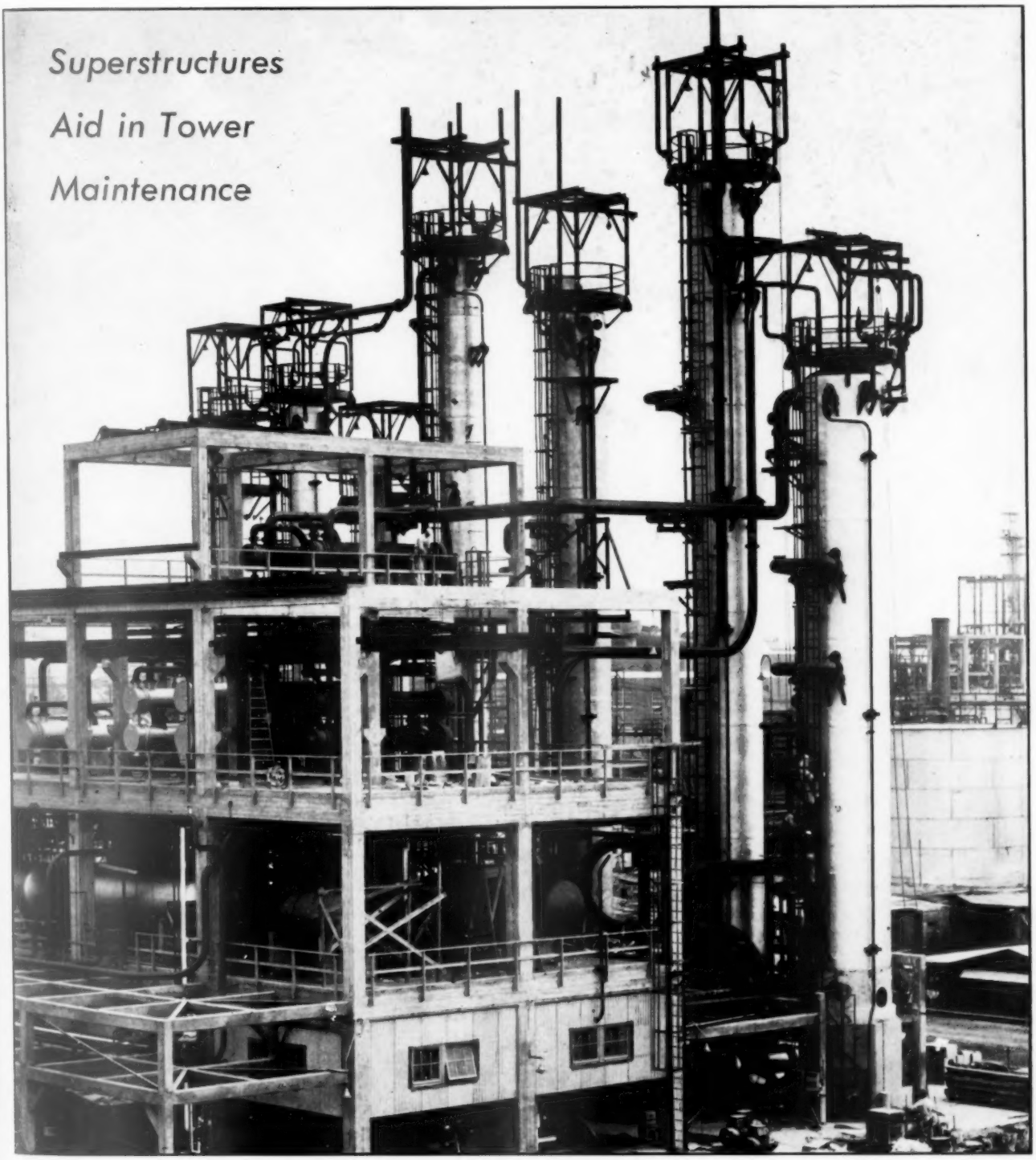
Monthly Technical Section Devoted to
REFINERY MANAGEMENT and PETROLEUM CHEMICAL TECHNOLOGY

MAR 9 1945

Section Two

March 7, 1945

Superstructures Aid in Tower Maintenance



TO FACILITATE REMOVAL and handling of trays during maintenance and cleanout periods, The Texas Co. erects superstructures atop its fractionating towers, such as shown in the above picture. In general, the facilities consist of a platform and overhead rigging, including a block and tackle that travels on a rail overhanging the edge of the tower. The seven towers shown here are the gas recovery unit for the Fluid Catalyst plant at Texaco's Los Angeles Works Refinery. Major additions to this plant, located at Wilmington, Calif., were completed last fall.

REPEAT PERFORMANCE

Trinity Gas Corporation Plant
Sejita Field, Duval County, Texas—1945

Trinity Gas Corporation Plant
Long Lake, Texas—1939

Typical of the many repeat performances by Hudson, for the same client, is the recently completed cycling plant of Trinity Gas Corporation at Sejita, Texas. It far exceeds in size, and variety of products, the small Long Lake plant completed for the same owner in 1939, but embodies the same high quality of engineering and construction.

★ ★ ★

Gas Compressor Stations ● Cycling Plants ● Gas Dehydration Plants ● Natural Gasoline Plants ● Fractionation Units ● Hydrogen Sulphide Removal Plants ● Mechanical and Natural Draft Cooling Towers

HUDSON ENGINEERING CORPORATION
Engineers and Constructors
HOUSTON, TEXAS
FAIRVIEW STATION

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PREVIEW

Feature Articles Coming Next Month

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Performance Record Of a Wartime Refinery

How the theoretical design considerations have actually worked out in a new refinery built from the ground up is told by an NPN Technical Section staff writer, based on a visit to the plant when the first turn-around of a major unit was scheduled. Inspection findings after the record-breaking 300-day run of a Fluid "cat cracker" are given, also a description of the propane deasphalting treatment for the preparations of a catalytic cracking feed stock.

1200 Lbs. of Cooling Water For 1 Lb. of Butadiene

Water for cooling and condensing the distilled vapors in manufacturing butadiene is not only required in large volumes, but the supply must also be without disturbance. Otherwise the chemical processing may be thrown out of line.

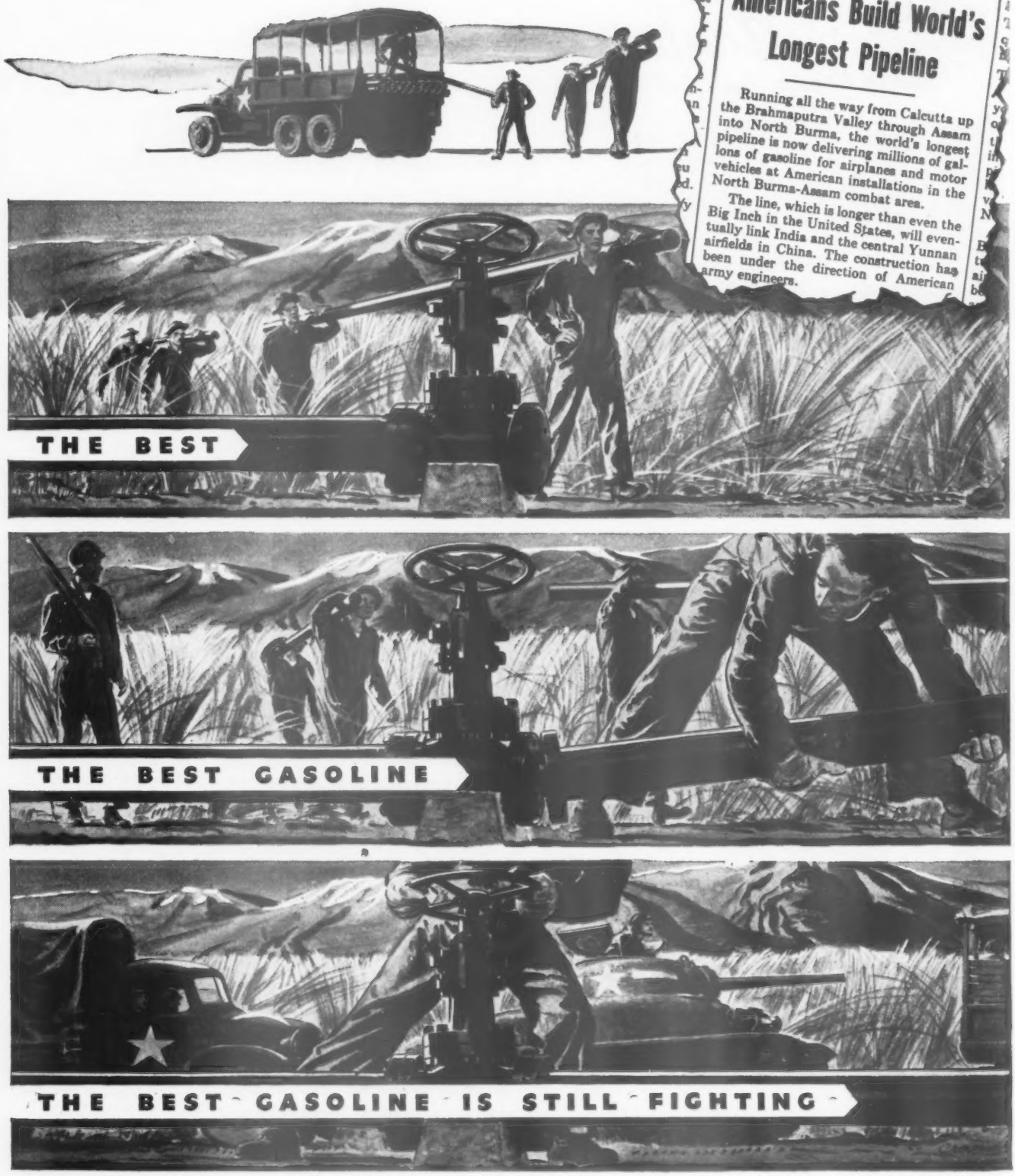
The equipment installed and methods used in water treatment at one of the large butadiene-from-alcohol plants is described. Details are given on the removal of contaminants from effluent water from butadiene and styrene operations by an authority in the plant.

Effect of Desulfurization On Octane Improvement of Sour Crude Distillates

A review of a hitherto restricted research report of the U. S. Bureau of Mines gives the results of studies on the increase in lead susceptibility of 25 different high-sulfur naphthas after vapor-phase desulfurizing with bauxite. The catalytic method, adapted from a commercial method, is described, together with methods of analysis for the various types of sulfur compounds present. The effect of these compounds on 1-C octane number enhancement with T.E.L. is demonstrated. A chart is included for estimating desulfurized octane number with up to 6ml T.E.L. per gallon.

The "House of Ideas"

Ideas are the keynote of operations at the newly-opened automotive research laboratory of one of the country's largest refiners. How these ideas have facilitated tests and overcome priority obstacles is described by a staff writer of NPN's Technical Section after a trip through the laboratory and an examination of the equipment.



Americans Build World's Longest Pipeline

Running all the way from Calcutta up the Brahmaputra Valley through Assam into North Burma, the world's longest pipeline is now delivering millions of gallons of gasoline for airplanes and motor vehicles at American installations in the North Burma-Assam combat area.

The line, which is longer than even the Big Inch in the United States, will eventually link India and the central Yunnan airfields in China. The construction has been under the direction of American army engineers.

By ship, by train, by truck and by pipeline millions of gallons of America's finest gasoline are going to our fighting men.

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REFINERY MANAGEMENT *and* PETROLEUM CHEMICAL TECHNOLOGY

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Maximizing Output from Wartime Plants Heads Refiners' Program for 1945

With New Facilities Largely Completed, Plant Operators and Technologists Are Now Coordinating Their Efforts to Achieve High Yields of Improved Quality Products

By Walter Miller

HUNDRED-OCTANE aviation gasoline, toluene for T.N.T. production, high quality lubricating oils for the needs of aviation and the armed forces, and synthetic chemicals for rubber manufacture again commanded the top priorities of the petroleum refining industry in 1944, the third year of America's active participation in the war.

The objective continued to be to produce more and more of these materials, to keep up with increasingly greater requirements.

By the end of the year all of the new installations projected before 1944, with the exception of possibly two or three that tailed over into January or February of 1945, had been completed and put into operation. With the consequent lessening of construction responsibilities and problems, the industry is in a position to concentrate on the new operations and to devote much more of its time and effort in achieving maximum output, both as to quantity and quality, from the new facilities.

Aviation Gasoline

Making high octane aviation gasoline continued as the prime requisite of refining activities during 1944. At the end of the year, the industry's sights were set to still higher figures than those which had been previously projected.

About July 1 daily output had been raised to 400,000 bbls. There were some few large plant installations still to be completed and put into operation. Indications were that by December production would be up to all requirements, with good inventories. However, although by the end of the year the industry was turning out something over 500,000 b/d, the estimated requirements of the armed services had been raised by a considerable figure due to the greatly increased aerial activities both in the European and Far Eastern combat areas.

By the end of the year, therefore, the picture had changed, what with the prospect for a much longer continuation of the European war. Even with the completion and putting into operation in the U. S. by January, 1945, of the last two or three 100-octane units authorized prior to 1944, it was evident it would be necessary to make still greater efforts to increase output of existing facilities to keep safely ahead of the game.

Efforts of the industry and PAW as well as of the PIWC Technical Advisory Committee and other research and development groups are concentrated therefore on methods and means to further augment the production of all existing refinery facilities engaged in making 100-octane aviation gasoline and components entering into it. The goal will be reached.

One of the means to increase coming production will undoubtedly be the more extensive use of stronger synthetic catalysts in many of the catalytic cracking units.

Announcement has been made of priorities having been granted for two additional large sized 100-octane plants, one of which will possibly be completed in 1945 and the other early in 1946; neither in time, however, to help materially during the present year.

Another possibility which has been worked on extensively during the past year is the hydrocarbon compound known as triptane (2,2,3-trimethylbutane). This has an octane blending value considerably in excess of toluene, and a gasoline made using triptane and tetraethyl lead is one of the most powerful combinations so far developed.

It is stated that a 12-cylinder Allison engine, with rated takeoff power of 1500 HP with 100-octane gasoline, developed over 2500 HP with triptane and tetraethyl lead blends. Triptane was practically a laboratory curiosity up to a short time ago. A pilot plant has been developed capable of producing 10 b/d which has made possible some fairly extensive testing in airplanes and other war equipment. This development is, of course, in a very secret stage, and no information is available as to whether and when large scale plants can or will be installed.

Plans have been announced for the manufacture of a new "super-fuel" of far greater power, developed by technologists of our refining industry, designed primarily for use of planes taking off from the decks of aircraft carriers, the flat-tops of our Navy, and in the B-29 bombers and the like. Only about half as much of this type of fuel can be made from a barrel of crude as the present regular 100-octane material, but no extensive changes in existing plants are required to produce it.

Many refineries are in position to start making this fuel quickly, but extensive manufacture will be delayed until the

---

For many years a summary of technological and economic developments in refining has been presented at the annual meeting of the American Institute of Mining and Metallurgical engineers by Dr. Walter Miller, in his capacity as chairman of the Committee on Refinery Engineering of the AIME Petroleum Division.

Since the war his reports have had added interest in that they reviewed the wartime program of the refining industry. Dr. Miller's positions as member of the Technological Committee of the Petroleum Industry War Council and as chairman of the 100-Octane Gasoline Sub-Committee and of the Technical Sub-Committee for PIWC District 2 bring him in close contact with the wartime program. He is vice president of Continental Oil Co., Ponca City, Oklahoma.

Since no annual meeting of the A. I. M. E. is being held this year, the original presentation of Dr. Miller's report was in the February Mining and Metallurgy, official journal of the A. I. M. E.

production of the present 100-octane material reaches an excess, as the making of the super-fuel entails a reduction in the ratio of about two barrels of the present fuel for every barrel of the new fuel produced.

Toluene for T.N.T.

At the end of 1943, refiners manufacturing toluene were in the position of making considerable in excess of the quantity needed for the T.N.T. requirements of the armed services, and the 100-octane gasoline program was helped by having the surplus diverted to it as a blending component for which it is highly suitable and valuable. However, despite some increase in the production rate of some of the plants, the excess is being reduced rapidly. The same factors which increased the need of aviation gasoline, namely greater aerial and bombing activities in the war areas, are responsible for higher T.N.T. requirements. The surplus of toluene available for 100-octane gasoline blending operations is therefore being lessened by something of the order of 5000 b/d increasing to that extent the burden on aviation gasoline manufacturers.

Efforts are also continuing to increase the output of existing facilities by research and development activities. Toluene is one of those petroleum materials which is critically important to the war program in more than one use.

Toluene is being produced by petroleum refiners in this war at rates 10 to 15 times as great as the quantity available in World War I, at which time the coal tar industry was practically the only source of supply.

High Quality Lubricating Oil

Practically all the large and small projects authorized prior to 1944 for the manufacture of high quality lubricants have been completed and put into operation. A number of minor additions to existing plants were authorized, including alterations to remove bottlenecks and increase output.

On the whole the available supply of lubricants exceeded the demands of the armed services, and there is no apprehension of any impending shortage of these products. Global inventories of the armed forces have, of course, been largely supplied, and current production has taken care of continuing needs. Should an unexpectedly larger consumption develop it might be necessary to take part of it from suitable quality lubricants now being used for civilian purposes, but such a situation is not expected to develop.

A large number of new plants have been projected on paper and submitted to Washington for postwar development and for quality improvement, some of which may be authorized before the end of the war. This presumably depends largely upon the availability of materials and labor necessary for their construction. Three projects in easy manpower localities are under immediate consideration in Washington, but none of them is authorized as yet. The high quality lubricating oil situation is well in hand.

Synthetic Rubber

It would appear that the petroleum refiners' contribution to the synthetic rubber program is being fulfilled as projected. No additional butadiene plants are planned; previously projected units are all completed and in operation. Most of them are capable of producing at better than designed rates. All as a group are turning out raw material for synthetic rubber faster than the tire manufacturers plants can use. On Rubber Director Bradley Dewey's recommendation his division of the War Production Board was dissolved the latter part of 1944, and the continuing of the rubber program taken over by the War Production Board as part of one of their other regular divisions.

Unfortunately for civilians it will still be a long time before tires will be freely available. Estimates have been made that restrictions will continue, in spite of ample raw material for synthetic rubber,

Dr. Walter Miller

at least throughout the year. Part of the difficulty responsible for this situation is, of course, the vastly increased requirements of the armed services beyond previous estimates, due to the extension of the European war and the increase in land activities in the Asiatic area. It may be well into 1946 before the average civilian will be able to get tires except under the most justifiable conditions.

There is still, of course, a great lack of finished tires, because the tire plants are suffering from a manpower shortage and excessive absenteeism. However, at least two new tire manufacturing plants have recently been completed, one in Oklahoma and one in Texas, which will help that situation somewhat, and the problem of the manpower shortage has been checked to the War Manpower Commission. The fact remains that the refining industry has made and is making good on its assignment in the synthetic rubber program.

The situation is not yet very clear as to postwar costs of producing synthetic rubbers and the competitive position of synthetic with natural rubber in the postwar era, but many indications are that the synthetic costs will be at satisfactorily low levels. Reliable figures should be available during the coming year, as the plants build up records on continuing operations.

Research and Development

As in previous war years, research and development efforts continued co-operatively under the joint auspices of PIWC and PAW, largely through the activity channels of the Aviation Gasoline Advisory Committee, the Toluene Technical Committee, and the Technical Advisory Committee. The number of petroleum technologists actively engaged in this co-operative research and development was considerably increased by enlargement of membership of the working subcommittees.

There was a definite broadening of process development work as the new plants went on the production line, necessary because of the incompletely developed new methods. The efforts of many of those who had been engrossed in the construction and preparation of the new units became available for problems concerned with the perfecting of operative technique, improving the continuity of operations, the further study of corrosion and erosion difficulties, and the establishing, for large scale operations, of the most practical and efficient conditions.

Much is being accomplished along this line by having regular meetings at about 60-day intervals in the various PAW refining districts of the operating and technological staffs of the plants engaged in producing 100-octane and its components. A forum is thus provided for a free and full discussion of all the questions affecting production rate, quality, and continued improvement in the utilization of these important manufacturing facilities. Thus is achieved a pooling of experience and knowledge gained by those men in the line of immediate direction and supervision, men actually on the ground about the facilities and in intimate contact with all operating steps and problems.

A development worth noting, although not near enough to be applicable to war production, is the growing interest in possible applications of the Fischer-Tropsch process, or modifications thereof, to some of our large gas reserves. This is one of the sources which are looked to for augmenting future crude oil supply as and when the oil wells fail to completely fill the demand.

Three or four pilot plants, the largest

(*Continued on p. R-176*)

Quality of Distillate Fuel Oils From Houdry and T. C. C. Operations

By S. P. Cauley and S. D. Dalton

The properties of fuel oils from catalytic cracking are affected by a number of variables, and the oils do not necessarily have common distinguishing characteristics as a class. Data are presented showing the properties of Houdry distillate fuel oils from both prewar and current commercial operations and of T.C.C. oils from current operations. These oils, without blending to meet distillation specifications, compare favorably with No. 2 grade pipeline fuel oil on the East Coast; after blending with 10-15% of kerosine or light naphtha, they have been found satisfactory for most domestic fuel oil burners. Burner tests on samples of Houdry and T. C. C. fuel oils, as produced, have shown that oils from intermediate-type charging stocks burn more satisfactorily in pot-type burners than oils similarly produced from naphthenic type stocks.

THE quality of domestic fuel oils from catalytic cracking units has been the subject of considerable general discussion during recent months by reason of the position that catalytic fuel oils have assumed during the war period and are expected to have during the postwar period. From these discussions, however, many people have formed an opinion that the term catalytically cracked fuel oil represents a "class" of oil having definite physical characteristics and questionable quality. Actually, without reference to type of catalytic process used, the term denotes nothing except the general method of processing to which an oil has been subjected.

It is the purpose of this paper to present data which show the quality of distillate fuel oils from only the Houdry and Thermofor Catalytic Cracking (T. C. C.) types of catalytic cracking processes.

Factors Affecting Quality

The quality of distillate fuel oils produced simultaneously with high quality gasoline is of considerable importance to economical operation of catalytic cracking units. The quality of such catalytically cracked fuel oils is affected by a number of variables, irrespective of the type of catalytic process used. Some of the most important of these are: type of crude from which the cracking charge is taken, boiling range of the charge stock, and extent of recycling during cracking.

In general, naphthenic type charging stocks produce a more "aromatic" fuel oil than is obtained from paraffinic and intermediate type charges. The boiling range of the charge stock also affects quality of catalytic fuel oils in that the amount of actual cracked material present in the fuel is increased by increases in boiling range of the charging stocks. Heavy gas oil charging stocks, therefore, produce distillate fuels containing more cracked material than those from light gas oil charge stocks. The distillate fuel oil is similarly affected by an increase in the amount of recycling of fuel oil to the cracking chamber.

The range of quality possible from the above mentioned variables is appreciable. It would, therefore, be difficult to modify a comparative discussion of the quality of Houdry and T. C. C. catalytically cracked fuel oils with many comments on differences in operating conditions. All of the data which are given in this report, however, are taken from results of commercial operations and are representative of actual production. On this basis we do not feel that complete data on operating conditions are necessary.

The data on Houdry fuel oils have been taken from both prewar and current operations, while those on T. C. C.

The above article on the properties of fuel oils produced by catalytic cracking has been prepared exclusively for the TECHNICAL SECTION of National Petroleum News by two engineers associated with Socony-Vacuum Oil Co., Inc., New York. Mr. Cauley is in the Technical Service Laboratories and Mr. Dalton in the Refinery Engineering Division.

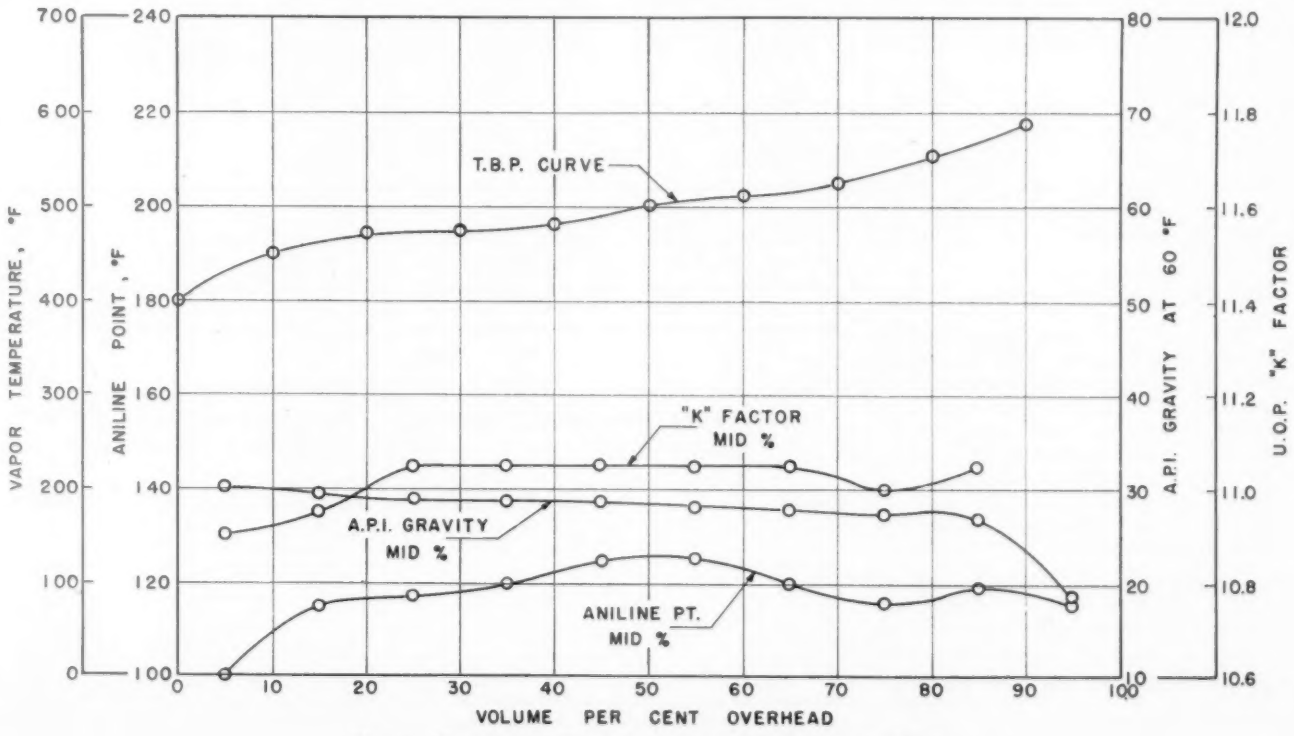


Fig. 1—Houdry distillate fuel oil: naphthenic type charge

TABLE I—Comparison of Physical Properties of Houdry and T.C.C. Distillate Fuel Oils with Current Pipeline Deliveries of #2 Fuel Oil

Refinery	A					B			C		
Time of Operation	Prewar	Prewar	Present	Present	Present	Prewar	Present	Present	Prewar	Present	Current
Type of Unit	Houdry	Houdry	Houdry	Houdry	T.C.C.	Houdry	Houdry	T.C.C.	Houdry	Houdry	Receipts
Type of Charge	Naph. Stock A	Int.	Naph. Stock A	Naph. Stock B	Mixed I & N	Int.	Int.	Int.	Int.	Int.	Pipeline No. 2
Catalyst Type	Clay	Clay	Syn.	Syn.	Clay	Clay	Syn.	Clay	Clay	Syn.	Fuel Oil
Gravity, °API	25	32	25	31	26	33	34	33.5	33	36	29.3
ASTM Distillation											
I.B.P. °F.	430	410	440	410	410	415	440	420	425	480	393
10%	470	450	475	440	460	470	485	470	475	505	458
50%	505	490	505	480	510	505	520	505	505	530	507
90%	575	560	570	530	585	580	585	550	560	570	576
E.P.	630	610	625	585	620	650	635	590	600	610	640
Recovery, %	98	98	98	99	99	99	99	99	99	99	99
ASTM Color	2½—	2—	2	1½	1½	2—	1½	1	1½—	2—	2½—
Pour Point, °F.	<—30	<—20	<0	<0	0	0	5	—10	—5	10	<0
Flash Point, °F.	200	185	215	200	205	190	230	200	190	210	180
Aniline Point, °F.	101	131	102	97	120	151	150	137	154	159	125
C/H Ratio (est.)	6.98	6.45	6.98	6.80	6.82	6.28v	6.19	6.35	6.27	6.18v	6.33
Cetane Number	25	40	25	33	28	45	46	45	46	53	34
Viscosity @ 100° F. SSU	37.5	34.5	36	34.5	36	35	36	34	35	37.5	36
Diesel Index	25	42	25	30	31	50	51	46	51	57	37
Con. Carbon on 10% Btm. %	0.20	0.10	0.10	0.10	0.10	0.10	0.07	0.04	0.10	0.05	0.07
Sulfur, %	0.20	0.25	0.20	0.20	0.20	0.20	0.21	0.23	0.30	0.30	0.31
Paraffins, %					49						
Olefins, %					29			25		18	
Aromatics, %					8						
Naphthenes, %					14						

TABLE I—(Continued)

Refinery	D		E		F		G		H	I	
Time of Operation	Prewar	Present	Prewar	Present	Prewar	Present	Prewar	Present	Present	Present	Current
Type of Unit	Houdry	Houdry	Houdry	Houdry	Houdry	Houdry	Houdry	Houdry	Houdry	T.C.C.	Receipts
Type of Charge	Mixed I & N	Naph.	Int.	Int.	Naph.	Naph.	Int.	Int.	Int.	Naph.	Pipeline No. 2
Catalyst Type	Clay	Syn.	Clay	Syn.	Clay	Syn.	Clay	Syn.	Clay	Clay	Fuel Oil
Gravity, °API	29	26	33.5	34	28.5	26	31.5	34	33	31	29.3
ASTM Distillation											
I.B.P. °F.	410	440	400	460	415	440	410	440	425	430	393
10%	460	470	450	490	450	490	460	495	505	470	458
50%	500	500	490	525	500	520	525	530	540	505	507
90%	560	560	560	595	575	600	620	590	590	565	576
E.P.	600	635	625	635	640	650	660	655	630	595	640
Recovery, %	99	98	98	98	99	98	99	99	99	98	99
ASTM Color	1½+	2—	2½+	1½	2½—	1½+	2½—	1½	1+	1+	2½—
Pour Point, °F.	0	<0	—10	10	<0	<0	30	10	10	<0	<0
Flash Point, °F.	190	200	190	225	190	200	190	205	190	175	180
Aniline Point, °F.	122	116	130	154	112	130	137	154	145	128	125
C/H Ratio (est.)	6.67	6.83	6.42	6.28v	6.77	6.58v	6.48	6.17v	6.33v	6.53	6.33
Cetane Number	36	26	39	49	32	30	41	48	48	35	34
Viscosity @ 100° F. SSU	35	36	34.5	36.5	35	37	36	36	37.5	35	36
Diesel Index	35	30	44	52	32	34	43	52	48	40	37
Con. Carbon on 10% Btm. %	0.15	0.15	0.12	0.05	0.10	0.05	0.10	0.10	0.06	0.04	0.07
Sulfur, %	0.20	0.20	0.22	0.22	0.08	0.17	0.20	0.17	0.24	0.25	0.31
Paraffins, %	50		59					76			
Olefins, %	15	26	21					17			
Aromatics, %	13		10					3			
Naphthenes, %	22		10					4			

fuels are representative of current processing.

Qualities of Houdry and T. C. C. Oils

The quality of any product is ultimately judged on the basis of performance, and in this respect the subject fuel oils have been found to be quite satisfactory. In general, however, the quality of a distillate fuel oil may be roughly shown on the basis of certain physical characteristics whose relationships to actual performance have been already fairly well established.

The physical properties of Houdry and T. C. C. distillate fuel oil produced from operations of Socony-Vacuum and its affiliates are given in Table 1 and compared with corresponding data on pipeline No. 2 fuel oil currently received at the East Coast.

It may be seen from Table 1 that the Houdry and T. C. C. distillate fuel oils, without blending to meet distillation specifications, compare very favorably with the pipeline product. The carbon residues of the current production are considered quite good for an untreated prod-

TABLE II

Comparison of Stabilities of Current Production of Untreated Houdry and T.C.C. Distillate Fuel Oils and "Pipeline" No. 2 Fuel Oil, Test Procedure "A"*

Sample	Type of Charging Stock	Type of Catalyst	Results of Stability Tests: Sediment Formed MGM/100 cc.	A. S. T. M. Colors: Initial	Final
Houdry	Int.	Syn.	0.0	2½	3½
T.C.C.	Int.	Clay	0.0	1	Lt. 1½
Houdry	Naph.	Syn.	0.0	2	Dk. 2
Houdry	Int.	Syn	0.0	1½	2½
Houdry	Int.	Syn	0.4	1½	Dk. 1½
"Pipeline" No. 2 Fuel Oil	...	...	1.2	2½	Lt. 4

*General Description of Test Procedure "A". A 100 cc. of the oil under test is put into an unstoppered 4 ounce bottle and is subjected to a 24 hour storage period at 212°F. The precipitate formed during this period is filtered from the oil and weighed. A.S.T.M. colors are noted on the original and final samples.

uct derived from a commercial cracking process. The carbon-hydrogen ratios of the fuels, which would be improved slightly after blending to distillation specifications, are also good. This characteristic is considered as of particular interest when a fuel is to be used in a vaporizing type burner.

Graphs showing physical properties of fractions of three Houdry and T. C. C. fuel oils are given in Figs. 1, 2 and 3.

The higher relative paraffinicities of Houdry and T. C. C. distillate fuels from intermediate type charging stock, as compared to those of fuel oil obtained from cracking a naphthenic charge, is shown by a comparison of "K" values* in Figs. 1, 2 and 3. This is also indicated by the aniline point curves.

The cetane numbers of Houdry and T. C. C. fuel oils from intermediate type charging stocks are, in our opinion, quite good for a cracked product. Diesel fuels composed of 90% or more of these oils have been marketed in some areas for three years and have been very well received. Those produced from naphthenic type charge have much lower cetane numbers and their usefulness is, therefore, subject to more limited applications.

Stability of Houdry and T.C.C. Oils

One very important characteristic of the Houdry and T.C.C. distillate fuel oils which cannot be shown by the usual physical tests is their stability. This subject is of sufficient interest to warrant separate considerations.

*"K" is the U.O.P. Characterization Factor, which is a measure of the relative paraffinicity of oils. Increasing values signify greater paraffinicity.

TABLE III

Comparison of Stabilities of Current Production of Untreated Houdry and T.C.C. Distillate Fuel Oils and "Pipeline" No. 2 Fuel Oil, Test Procedure "B"**

Sample	Type Charge	Residues of Evaporation, MGM/100 cc. Original	Final
St. Run Diesel Fuel		4.0	4.4
Houdry	Intermediate	6.0	11.2
T.C.C.	Int. and Naph	3.0	8.7
Houdry	Intermediate	1.6	10.3
T.C.C.	Naphthenic	4.0	5.0
Houdry	Naphthenic	5.6	7.3
Houdry	Intermediate	1.8	4.8
"Pipeline" No. 2 Fuel Oil		7.2	17.9

**General Description of Test Procedure "B". A 50 cc. sample of oil to be tested is evaporated completely at a temperature of 500°F. in a nonoxidizing atmosphere, and at an absolute pressure of 15 MM Hg. Runs are made on a sample before and after a storage period of 24 hours at 212°F.

The stability of all current production of Houdry and T.C.C. fuel oils shown in Table 1 is very good and none require treatment of any kind prior to their use as burner fuels. In order to show the stability of these oils against formation of sediment and other oxidation products the results of special stability tests are given in Tables 2 and 3. The test methods used are arbitrary but have been selected for use on the basis of considerable work on the matter of evaluating the stability of distillate fuel oils.

Test Procedure "A" (Table 2) has been found to be reasonably good in detecting oils which may cause filter plugging. The results of this test are in fair agreement with the amount of sediment formed in a storage period of four months. It does not, however, give an indication of the intermediate oxidation products or gums which have been formed and only gives the amount of sediment produced during the heating period. A second test method is, therefore, used to measure the sum of the intermediate oxidation and end product formations, and results of tests using this method are given in Table 3:

Although no correlation of storage tests has been made with results of Test Procedure "B", it has been found to be very useful in comparing stability characteristics of distillate fuel oils. Reproducibility of the procedure is good.

Photographs of sample flasks following evaporation of various types of samples (prior to storage at 212° F.) are shown in Figs. 4 and 5.

The photograph shown in Fig. 4 was taken in 1941 and the Houdry sample

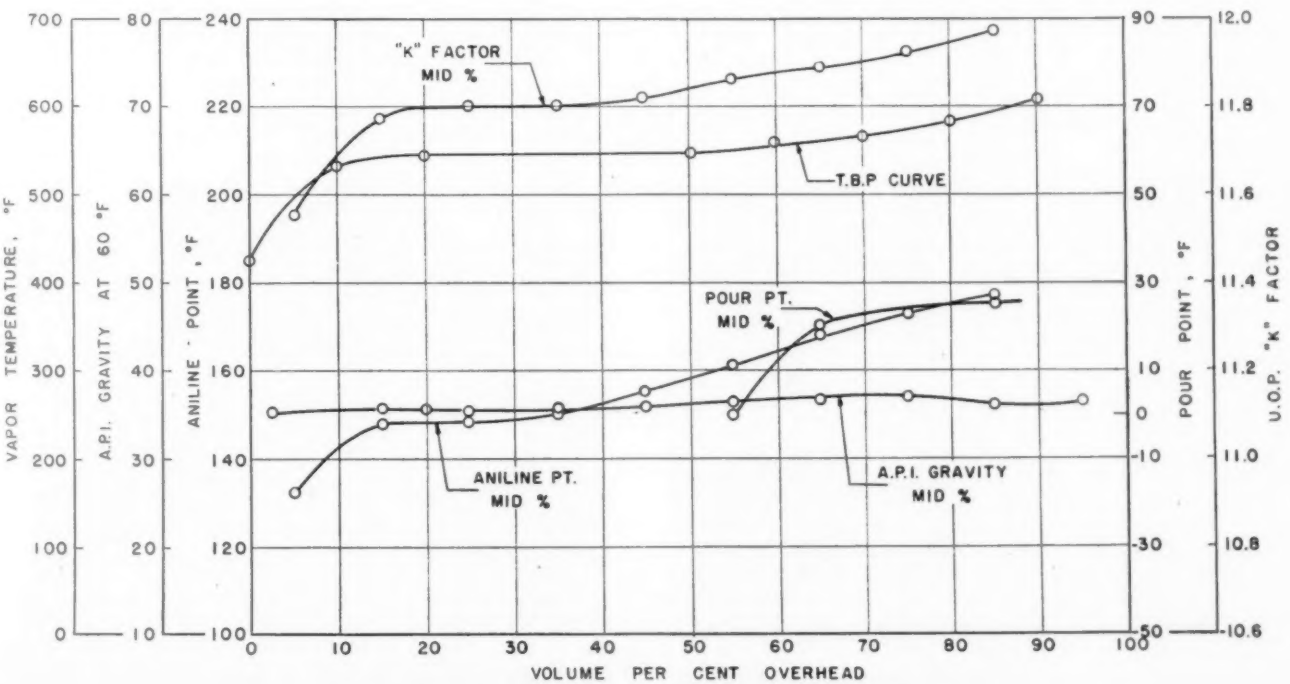


Fig. 2—Houdry distillate fuel oil: intermediate type charge

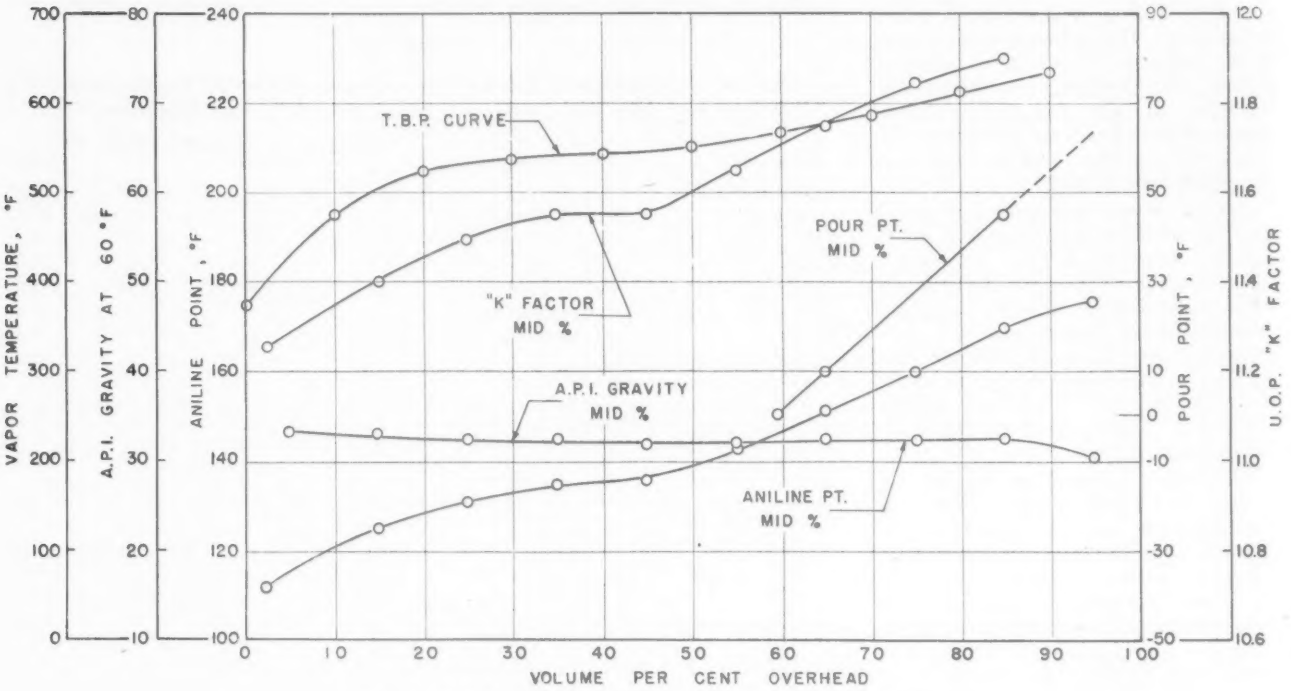


Fig. 3—T.C.C. distillate fuel oil; intermediate type charge

was representative of production on clay catalyst at that time. The weights of residues for the straight-run, Houdry, and thermal distillate fuel oils shown are 2.0, 5.6, and 38.0 mgms/100 c.c. respectively. Similar values for straight-run and current production of T.C.C. (clay catalyst), and Houdry (synthetic catalyst) fuels shown in Fig. 3 are 4.0, 3.0 and 5.6 mgms/100 c.c. respectively.

Performance Characteristics

The Houdry and T.C.C. distillate fuel oils as obtained from operating units do not meet existing 10% distillation specifications of No. 2 fuel oil. They must, therefore, be blended with a small amount of kerosine or light naphtha before being marketed. These fuels have been found to give satisfactory performance in domestic fuel oil burners after blending with approximately 10-15% of a lighter oil.

Burner tests have been made on samples of Houdry and T.C.C. fuel oils, as produced, to check their performance in vaporizing pot-type burners which are more critical of the type of oil used than pressure and rotary types of burners. From this work it was found that the Houdry and T.C.C. distillate fuel oils from intermediate-type charging stocks would burn satisfactorily in such burners although not always as well as a straight-run No. 1 fuel oil, which is ordinarily required. The fuel oils as produced from naphthenic charging stocks, however, were unsatisfactory for this type of burner. Their usefulness is, therefore, restricted to use in the less sensitive types of burners which at the present time are used in the majority of domestic heating units.

Conclusions

The Houdry and T.C.C. fuel oils now being produced are of good quality and are giving satisfactory performance.

The stabilities of Houdry and T.C.C. fuel oils are excellent, and chemical treatment should not be required except when they have been subjected to unusual operating conditions. In general, the quality of T.C.C. fuel oil produced is somewhat better than Houdry fuel oil produced under the same general conditions of operation.

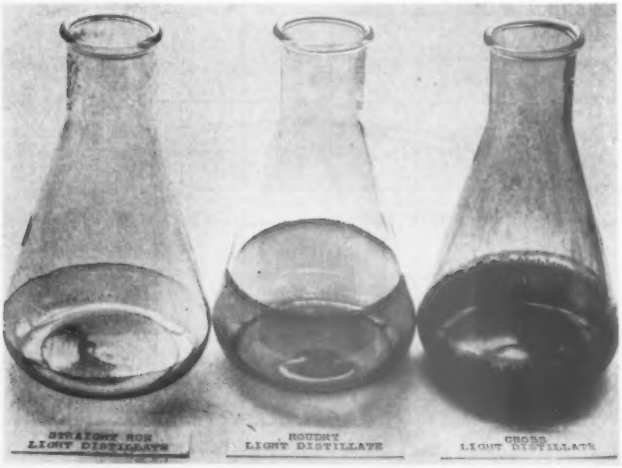


Fig. 4—Comparison of evaporation residues of straight-run, Houdry (prewar) and thermal distillate fuel oils

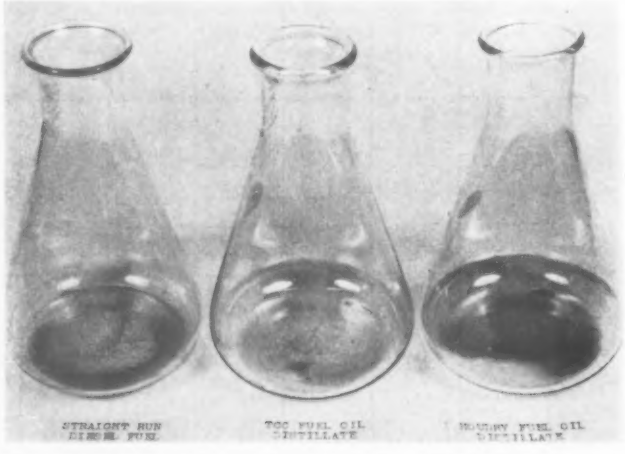


Fig. 5—Evaporation residues of straight-run and current Houdry and T.C.C. distillate fuel oils

Precise Fractionation in the Petroleum Industry

By P. S. Verity

The close fractionation required to produce many of the new petroleum products calls for more exact design and engineering of the multi-tray continuous distillation towers used. Complete analytical data on the hydrocarbon feed stocks for use in making an economic balance between product yield and properties, and cost of equipment is difficult to secure. A method is described for reducing this analytical work by the segregation and study of hydrocarbons by groups. For purposes of calculation each group is treated as a single hydrocarbon.

Pilot-plant equipment has been designed to isolate individual hydrocarbon groups as a means of securing design data for precise fractionation columns. A following article will describe this 6-inch pilot plant column.

ALTHOUGH fractional distillation in oil refining is as old as the industry itself, it is only during the past decade that columns having 30 or more bubble trays have come into common use.

The term "Precise Fractionation" is of relatively recent usage and is difficult to define accurately. In a general sense, however, it may be used to describe the separation by distillation of close-boiling materials where at least 30 bubble trays, or the equivalent, are employed.

An early use of precise fractionation in petroleum refining was for the stabilization of natural and cracked gasolines, which became general in the early thirties, as soon as it was realized that storage losses could be reduced and larger yields of gasoline of a given vapor pressure obtained. Later developments in this field were in the direction of eliminating isobutane and retaining normal butane which has a 60% lower vapor pressure.

During this period, which lasted until a few years before the present war, there was a general tightening-up of the volatility specifications for petroleum products, particularly in regard to end-point, and this trend was accompanied in the industry by a slow but continuous improvement in crude oil topping equipment. Improved efficiency led to slightly increased yields of more marketable products but as specifications were generally written in terms of the ASTM or Engler distillation, a limit was soon reached in the degree of fractionation which could be economically justified.

The petroleum industry has been placed ahead of all others in the use of effective distillation equipment, by the development of modern synthetic processes, such as alkylation, isomerization, polymerization, butadiene and toluene production, which require material consisting either of pure hydrocarbons or narrow-boiling fractions containing only a few components. Among the narrow-boiling range groups of hydrocarbons, the most important is the C_4 fraction, known also as BB, which is produced from cracking plant gases. This is the major raw material for the production of alkylate and hydrocodimer, which in turn are the basic ingredients of 100-octane aviation fuel.

Since about 1940 a very large number of fractionating columns having 30 or more bubble trays have been built in connection with distillation processes, and groups of tall towers form the most striking feature of modern 100-octane and synthetic rubber plants.

Alkylation

As an example of the use of precise fractionation in a modern process, it may be of interest to describe briefly a typical alkylation unit. This process is relatively simple from a chemical point of view. Butylenes or other light olefins are reacted with isobutane to produce an aviation gasoline component known as alkylate, consisting largely of branch-chain paraffins of high octane number. A typical alkylate made from butylene and isobutane has an octane number, after addition of tetraethyl lead, of about 107, and is blended with a base stock of octane number below 100, to produce finished 100-octane fuel.

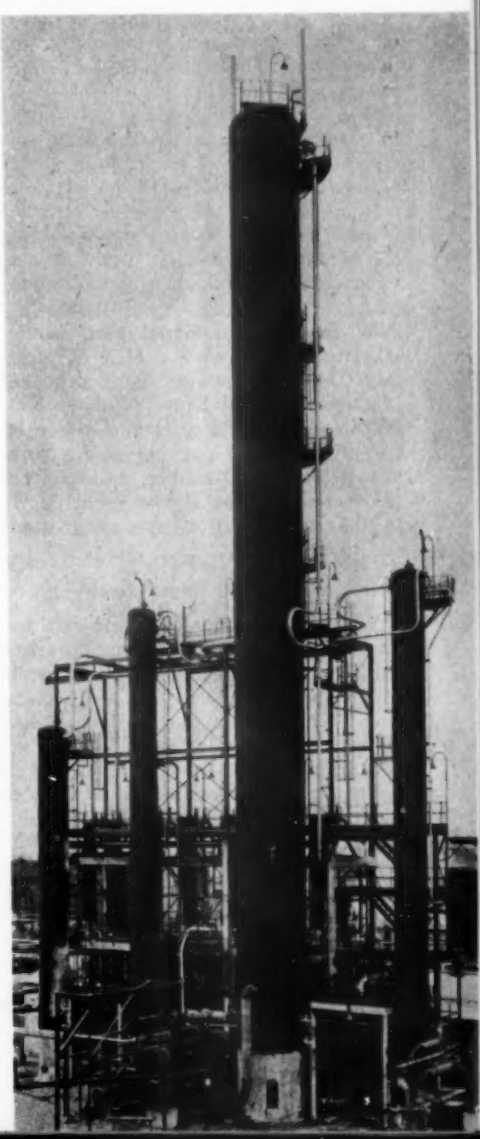
The feed to the alkylation process normally consists of C_4 fraction, although C_3, C_5 and C_6 fractions are also used, and is made by fractionation of liquefied cracked gases in towers having 30 to 40 trays, usually located in a gas recovery unit associated with the main cracking plant. The C_4 fraction, which is a liquid of about 60-pound vapor pressure, is stored under pressure in spherical or cylindrical tanks and charged directly to the alkylation reactors, together with isobutane recycle from the fractionation section of the unit. The effluent from the reactor system contains only paraffin hydrocarbons and this mixture is then subjected to a series of precise fractionations to separate it into its individual components. Typical overhead and bottom compositions for the various towers are recorded in Table 1.

The reactor effluent, after being washed with caustic soda to remove traces of acid, is charged to a depropanizer tower usually having 40 bubble trays, in which propane and lighter hydrocarbons are taken overhead as gas. A typical tower would operate at 275 psi pressure and a molal reflux ratio of 0.8:1, based on feed.

The bottoms from the depropanizer pass to a deisobutanizer where separation is made between isobutane, boiling point 14°F., and normal butane, boiling point 31°F. Isobutane is taken overhead as a liquid product and recycled to the reactors. Owing to the small difference in boiling point between isobutane and normal butane, a large number of bubble trays and a high reflux ratio are required for their separation, typical figures being 60 bubble trays and a reflux ratio of 7:1 based on overhead product, at an operating pressure of 125 psi. Deisobutanizer towers are among the tallest in use in the industry and represent a large part of the total cost of an alkylation unit. To get some idea of the magnitude of the quantities involved, the following calculation is of interest.

Each volume of finished alkylate consumes about 0.62 volumes of olefin. At an isobutane/olefin ratio of 8:1, this means 5.0 volumes of isobutane entering the reactor for each volume of alkylate produced. Assuming a reflux ratio

Comparative heights of the towers in this alkylation plant illustrate the importance of deisobutanization



The above article was originally published in the August-September, 1944, issue of Heat Engineering of the Foster Wheeler Corp., refinery engineers. Mr. Verity, the author, is a process engineer in the Petroleum Refinery Division of Foster Wheeler.

TABLE 1.—Analysis of Alkylation Unit Products

	Reactor Effluent	Depropanizer		Deisobutanizer		Debutanizer	
	% Vol.	Tops % Vol.	Bottoms % Vol.	Tops % Vol.	Bottoms % Vol.	Tops % Vol.	Bottoms % Vol.
Propane	1.1	95.0	0.6	0.8	....	....	....
Iso-Butane	59.2	5.0	59.2	89.5	0.5	1.0	....
n-Butane	25.1	....	25.5	9.7	56.1	99.0	0.6
Alkylate	14.6	....	14.7	....	43.4	....	99.4

of 7:1 in the deisobutanizer, this corresponds to vaporizing and condensing 35 times as much isobutane as the volume of alkylate produced and explains the apparent disproportionality of the deisobutanizer in a typical alkylation plant. Such plants can often be recognized by the one very large tower surrounded by a number of smaller towers.

The bottoms from the deisobutanizer are charged to a debutanizer having 30 or 40 trays, where substantially pure normal butane is taken as overhead and crude alkylate as bottoms. A typical debutanizer would operate at a reflux ratio based on overhead product of about 3.5:1 and a pressure of about 100 psi. Owing to the deficiency of isobutane in most feed stocks, it is usual to charge the normal butane to an isomerization unit where it is converted to isobutane. As the catalysts used in isomerization are sensitive to small amounts of pentanes, very complete elimination of pentanes from the overhead product has to be accomplished in the debutanizer tower.

The debutanizer bottoms are charged to a rerun tower having about 20 trays and operating at about 1:1 reflux ratio and a few pounds pressure. Approximately 95% is taken overhead as finished 300°F. end-point aviation alkylate, the bottoms consisting of heavy naphtha which is usually blended into motor gasoline.

When it is considered that aviation alkylate constitutes about 30% of the total 100-octane gasoline being produced (the latest official figure is about 500,000 b/d) it will be realized what an extremely important part precise fractionation is playing in winning the war. The same applies in an almost equal degree to the production of synthetic rubber and toluene.

Base Stock Improvement

When 100-octane aviation gasoline was first manufactured, it consisted essentially of hydrocodimer or alkylate with straight-run base stock and isopentane. Although production was at first limited primarily by facilities for the manufacture of the hydrocodimer and alkylate, a more fundamental bottleneck was the supply of high-quality straight-run base stock. Most of the naphtha produced from crude oil is of relatively low octane rating, requiring a very high proportion of alkylate to meet 100-octane specifications, and the amount of high-grade straight-run naphtha available was quite inadequate to meet the wartime demand.

The story of how this bottleneck was ultimately broken by the huge development of catalytic cracking, is one of the most fascinating in the history of the Battle of Production. However, in the early stages of the war it seemed as if Precise Fractionation to improve poor quality naphthas by removal of normal paraffins, was the only hope for producing the quantities of 100-octane required.

The principle of the precise fractionation process is to cut the gasoline into fractions of high and low octane number, the former containing branch-chain paraffins and naphthenes, and the latter containing normal paraffins, although in practice a sharp separation into these groups cannot be obtained. A list of the hydrocarbons boiling between 82°F. and 212°F. occurring in crude oil is given in Table 2, and is based on the work of Rossini and others.

Owing to the extremely low octane rating of the normal paraffins, it is usually more important to keep them out of the high octane fractions than it is to recover the maximum quantity of the latter. Naphtha improvement by precise fractionation is, of course, a process in which there is an inverse relationship between yield and quality, and for many low-octane gasolines the yield of high-quality material that can be obtained is very small and the costs of the process are high. Nevertheless, where large quantities of gasoline are available and catalytic cracking has not been installed, precise fractionation has proved a valuable method of increasing 100-octane production. In the case of naphthenic oils, large yields of excellent blending stock are being made by precise fractionation at low cost.

Referring to Table 2, the hydrocarbons have been arranged in order of boiling point and are listed in groups marked "A," "B," etc. The hydrocarbons in each group boil very close together so that little or no separation takes place even in very efficient commercial columns, and for design calculations each group can usually be considered as if it were a single hydrocarbon. The high- and low-octane fractions occur alternately in order of boiling point and can be made either on a number of continuous columns operating in series or in a single operation on a batch column. The names and compositions of the various fractions are listed below:

Fraction	Octane Rating	Composition
Iso-pentane	high	Group A
n-pentane	low	Group B
Iso-hexane	high	Group C, plus part of Group D.
n-hexane	low	Group E, plus part of Group D and some methylcyclopentane.
Iso-heptane	high	Groups F and G, plus part of Group H.

It will be noted that no boiling point has been assigned to benzene. Aromatics show abnormal vapor pressure in admixture with paraffins and naphthenes and tend to distill at lower temperatures than their true boiling points. In practice, any benzene is distributed between the *n*-hexane and the *iso*-heptane fractions.

In the design of continuous fractionating equipment, the number of plates and the reflux ratio required for the different separations vary considerably. The most difficult separation is between Group E and Group F where the difference in boiling point between normal hexane and methylcyclopentane is only 5.5°F. It is usual to specify a maximum *n*-hexane content for the *iso*-heptane fraction.

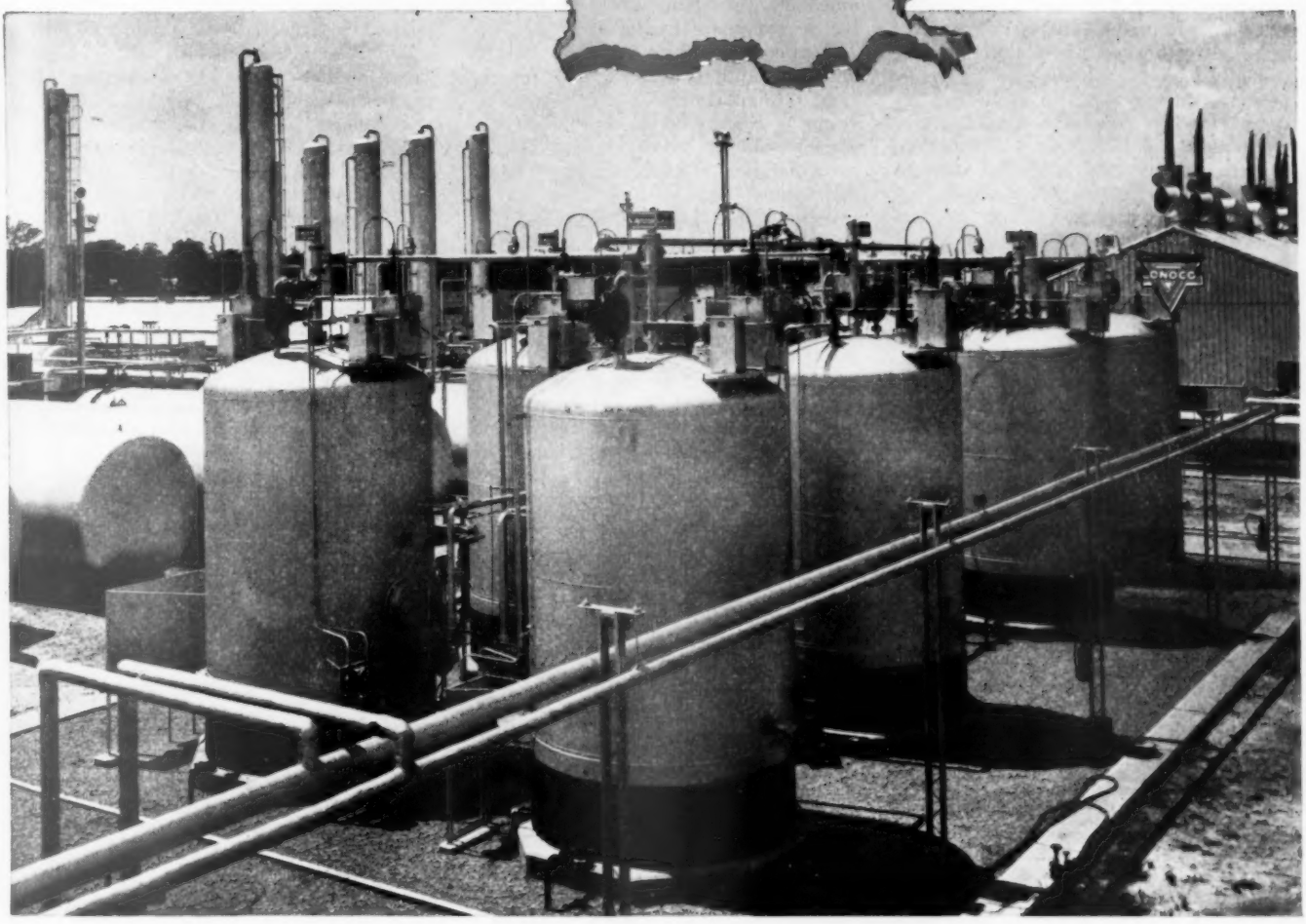
Owing to the very low octane rating of *n*-heptane, it is essential to keep the concentration of Group I in the *iso*-heptane fraction to a very low figure, usually below one-half per cent. Group H, which consists of five close-boiling hydrocarbons, is only of medium octane rating and it is customary to include just

TABLE 2.—List of Hydrocarbons in Straight-Run Gasoline

Group	Hydrocarbon	Octane Rating*	Boiling Point °F.
A	Isopentane	High	82
B	n-Pentane	Low	97
C	Cyclopentane	High	120
	2, 2-Dimethylbutane	High	121
D	2, 3-Dimethylbutane	High	136
	2-Methylpentane	Medium	140
	3-Methylpentane	Medium	146
E	n-Hexane	Very Low	156
	Benzene	High	.. **
F	Benzene	High	**
	Methylcyclopentane	High	161.5
G	2, 2-Dimethylpentane	High	175
	Cyclohexane	High	177.5
H	1, 1-Dimethylcyclopentane	Medium	189.5
	2-Methylhexane	Low	194
	1, 3-Dimethylcyclopentane	Medium	195
	1, 2-Dimethylcyclopentane	Medium	197
	3-Methylhexane	Low	197
I	n-Heptane	Very Low	209
	Methylcyclohexane	Medium	212

*As determined by latest test methods for aviation gasoline on blends containing T.E.L.
**Benzene shows anomalous vapor pressure.

In Louisiana... Where salty crude is an operating problem CONOCO relies on Petreco Desalting



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It is significant that where salt-bearing crudes are encountered, Conoco employs Petreco Desalting. It is significant also that Conoco first installed a single unit Petreco desalter . . . followed by three Petreco units in another plant . . . and quickly thereafter by an additional installation of eight Petreco units. Recently Petreco completed a specially designed high-capacity desalter for Conoco in still another refinery.

These "repeat" installations for a company of Continental's caliber are graphic proof that Petreco Desalting efficiently conditions crude to meet strictest manufacturing specifications.

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as much of this group in the *iso*-heptane fraction as is allowed by the quality specification.

The design of a multicolumn continuous unit for the precise fractionation of a specific gasoline would appear at first sight to require a complete hydrocarbon analysis of the feed stock, similar to the hydrocarbon analyses of typical gasolines published by Rossini. Unfortunately, such analyses are extremely tedious and expensive to make and require highly specialized laboratory equipment and technique. In addition, in order to use the analytical data to make a proper economic balance between product octane rating, product yield and cost of equipment, it would be necessary to have accurate octane ratings on each of the pure hydrocarbons present, and even with these data, the resulting calculations would be very complex and difficult.

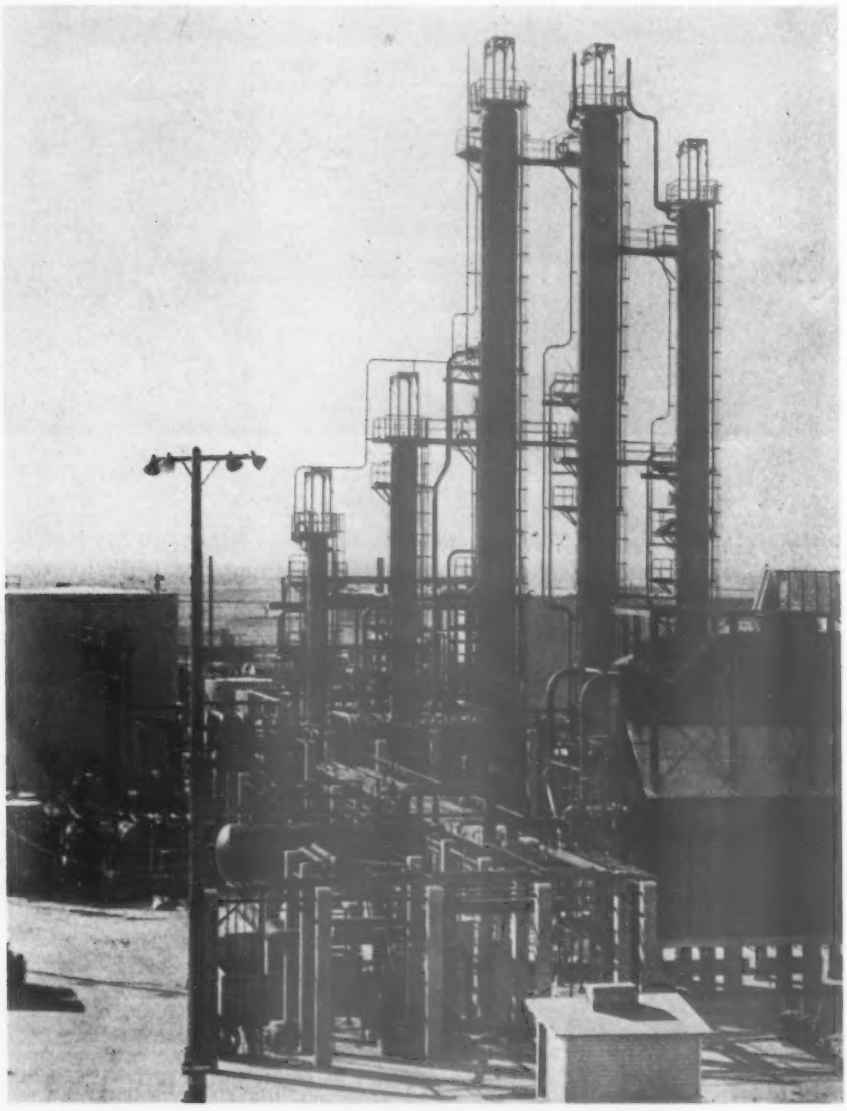
The amount of work involved, however, can be greatly reduced by the method of segregating the hydrocarbons into separate groups as shown in Table 2, and treating each group as a single hydrocarbon for the purpose of calculation. By the use of modern equipment, such as the 100-plate, 6-inch pilot Stedman column, it is possible to isolate the individual hydrocarbon groups, in sufficient quantity for engine testing, in much less time than would be required for a complete hydrocarbon analysis. The calculation of an economic balance between equipment cost and product yield is then greatly simplified, as each group is considered as a single hydrocarbon with an octane rating, for the particular feed stock, determined by actual engine test.

Perhaps the above considerations can be made clearer by example. Group H, in Table 2, consists of five close-boiling hydrocarbons, all of which are difficult to prepare in the pure state and the relative quantities of which vary considerably from one gasoline to another. The octane rating of this group will, therefore, be quite variable but once it has been determined for a given gasoline, the figure so obtained can be used directly to calculate the amount of Group H which can be permitted in the iso-heptane fraction in order to meet any required specification. Similarly, the octane rating of Group I is very variable from one gasoline to another, depending on the ratio of *n*-heptane to methylcyclohexane. If the *n*-heptane content is large, a lesser amount of this group can be tolerated in the *iso*-heptane fraction and a greater degree of fractionation will be justified.

Separation of the charge stock into seven groups (omitting *iso*-pentane and *n*-pentane) and the determination of their octane ratings, gives much more directly useful data for the design of continuous distillation equipment than does the usual determination of octane ratings on one-degree or one-per cent fractions on the whole charge.

Owing to the relatively large differences in boiling point between the groups, simple refractionation of each group, as made on the pilot column, is sufficient to eliminate unwanted hydrocarbons. There is, however, one exception; namely, the separation between Group E and Group F. In this case, it is better to lump the two groups together in the preliminary analysis and determine *n*-hexane, methylcyclopentane and benzene in the mixture by chemical and physical analysis. It is then possible to estimate the number of trays and reflux ratio necessary for any required separation between Group E and Group F.

Although the hydrocarbon - group method outlined above is not absolutely exact, it is believed to provide adequate data for the design of continuous distillation equipment with a minimum of laboratory analysis and testing.



This toluene unit employs extensive precise fractionation

Control Problems

The control of continuous columns having 50 to 100 bubble trays and operating at high reflux ratio, has presented a number of problems. In general, the most satisfactory method seems to be to maintain constant feed rate and constant heat input to each column and to control the quality of the products by setting flow controllers in the overhead product streams.

Reflux flow is automatically adjusted to maintain a constant level in the reflux accumulator, the reflux ratio varying with the amount of product taken overhead. This method of control gives exceedingly steady column operation.

The success of any continuous fractional-distillation operation depends upon the maintenance of constant compositions on each tray, and constancy of heat input eliminates one of the major factors tending to upset this condition. With the system of control by product flow, absolute uniformity in feed quality is also essential and it has been found desirable to provide large-capacity storage tanks which can be stirred, or circulated with a pump, to provide complete mixing.

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New Plant Facilities Boost Aviation Gasoline Production Fifteen-Fold

WARTIME installations and improvements in the Avon, Calif., refinery of the Tide Water Associated Oil Co. have increased its output of 100-octane gasoline to well over 15 times its 1940 production. Among the new features are:

1—A pentane isomerization plant, said to be the first of its type ever constructed.

2—A Fluid Catalytic cracking unit with design capacity of 16,000-b/d of gas oil charging stock.

3—Installation of a 25,000 b/d charge capacity vacuum tower, which operates on straight-run residuum from the crude stills, to supply overhead up to 10,000 b/d charge for the "cat" cracker, bottoms going to the viscosity breaker.

4—Extensions to the alkylation plant and improvements in the gas recovery plant. A new feature in the latter is the provision of a water wash tower to cleanse the gas after the first stage of compression, and also the raw gasoline from the main distillate receiver. This washing removes products of cracking which might affect efficient operation of the gas plant towers.

5—Deeper cracking in the thermal cracking units to maximize the supply of alkylation feed stocks.

Pentane Isomerization

The pentane isomerization unit of Tide Water Associated Oil Co., licensed from Shell Development Co., is said to be the first of its type ever constructed. The plant synthesizes isopentane, an important ingredient of aviation gasoline, from normal pentane. A liquid catalyst is employed, of which the active ingredient is aluminum chloride. The reaction is controlled by the proper use of reaction promoters and suppressors, such as hydrogen and hydrogen chloride.

Fluid Catalyst Unit

The Fluid catalytic cracking plant, said to be the world's largest single unit of its type, has a design capacity to charge 16,000 b/d of gas oil, cracking 72% into gasoline and lighter fractions in a single pass through the reactor. Catalyst circulating capacity is in excess of 40 tons per minute, with coke burning capacity in the regenerator in excess of 16,000 pounds per hour.

In the Avon unit no furnace is needed for preheating the charge oil. The oil reaches the temperature required for the reaction from heat imparted to the moving catalyst in the regeneration step. After combustion, catalyst at a temperature of about 1050° F. or higher is contacted with the fresh oil charge, which has been preheated to approximately 400° F. through heat exchange.

The cylinder portion of the reactor is 27 ft. in diameter by 54 feet high on the straight side. The bulk of the entrained catalyst in the oil vapors passing out of the reactor is recovered in the Multiclone unit and returned to the system. The cracked oil vapors are charged to the 17 ft.-6 in. by 89 ft. fractionating tower, where separation of the catalytically cracked products is obtained. Both reactor and fractionator are alloy lined to permit operation on a variety of feed stocks.

The regenerator vessel has an effective diameter of 46 ft. and a cylinder height of 30 ft. after allowing for the space occupied by the Bigelow-Liptak refractory lining. The regenerator is equipped with a Meehanite distributor grid and two regenerated catalyst draw-offs, one for the regenerated catalyst return to the reactor and the other for the recycle catalyst steam generator exchangers, which act as a temperature controller.

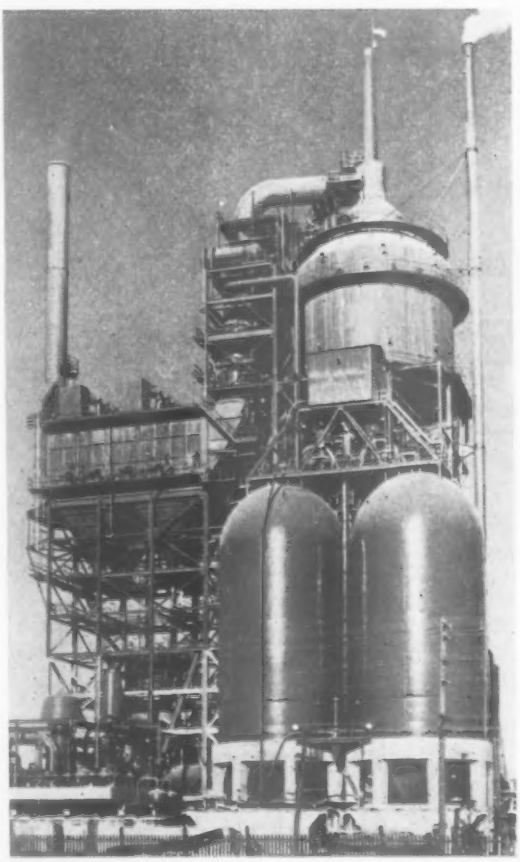
Large Capacity Vacuum Tower

In order to augment the supply of virgin gas oil from the Avon crude distillation units, a vacuum feed preparation unit was built and is operated in conjunction with an existing thermal viscosity breaking unit. Straight-run residuum from the crude stills containing waxy gas oil, is charged through heat exchange on the viscosity breaking unit into a new 50,000,000 Btu per hour fired tubular heater designed to operate at transfer line temperatures of up to 690° F. The transfer line enters the bottom section of a vacuum tower which is 24 ft. diameter and 22 ft. high on the straight side.

This vacuum tower is designed to operate at 50 mm. mercury absolute pressure in the flash section. It is provided with four specially designed fractionating trays and has a design charge capacity of 25,000 b/d of residuum, with the ability to take overhead 10,000 b/d or more of well fractionated oil. This product forms part of the charge to the new catalytic cracking plant. The heavy residuum bottoms are thermally cracked in the adjacent viscosity breaking unit.

The gas recovery stabilization unit provided for the new catalytic cracking plant processes both the liquid and the gas products from the main fractionating tower. Five 800-HP Clark compressors take suction on wet gas from the distillate condenser at substantially atmospheric pressure, raising the pressure to approximately 40 pounds gauge in the first stage of compression. Each engine is provided with both low and high-stage gas compression cylinders, so that each compressor is a self-contained unit.

A feature in the Avon gas recovery plant is the provision of a water wash tower to cleanse the gas after the first stage of compression, and also the raw gasoline from the main distillate receiver. This provides the ability to process gas oils which might be high in nitrogen compounds, removing products of crack-



Fluid catalytic cracking plant at Tide Water's Avon refinery. The unit has a charge capacity of 16,000 b/d of gas oil, and cracks 72% of the charge into gasoline and lighter fractions in a once-through operation. Spherical-topped vessels in foreground are for catalyst storage, with catalyst regenerator behind and above them

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ing which may affect efficient operation of the gas plant towers.

The washed gas is picked up into the suction of the second stage cylinders and boosted to a pressure of 175 pounds gauge, where it enter a 40-tray absorber-demethanizer column. The raw gasoline from the water wash tower bottoms enters the lower section of the absorber-demethanizer and sufficient absorption oil is circulated over the top of the tower to recover 70% or more of the propane-propylene fraction and substantially all the heavier hydrocarbons. An intercooler is provided near the center of the absorber, and the bottom section is provided with a reboiler to eliminate as much methane and ethane as possible from the rich absorption oil before further processing.

The rich oil is charged into a 30-tray still, where an overhead fraction of about 200° F. end point is recovered. This fraction is charged into a 40-tray depropanizer tower, taking overhead the propane-propylene cut which is further processed for hydrogen sulphide removal in a Girbotol purification unit. The bottoms from the depropanizer tower are charged into a 40-tray debutanizer-dependanizer tower for recovery of alkylation feed stocks, and light catalytic naphtha is removed as the bottom product.

The bottoms from the still referred to above, comprising the material largely in the range of 200°-400° F., are split into two streams, part going to the absorber demethanizer as absorption oil and part to a 30-tray splitter column where a 200°-340° F. aviation naphtha cut is taken overhead, and heavy motor naphtha removed as the bottom product.

All of these plant facilities were constructed by C. F. Braun and Co. as Tide Water Associated's contractor. The Fluid unit proper is licensed by Universal Oil Products Co., who also furnished the process engineering design.

Severe Thermal Cracking

Operations of all refining units have been affected by the pressing demand for increased quantities of 100-octane aviation gasoline. For example, thermal cracking units are being operated at severe temperatures to maximize the supply of alkylation plant feed stocks. One thermal cracking plant at Avon has been converted to reforming service and is operating at transfer line temperatures of 1110°-1135° F., producing 7 vol.-% of butylenes on the feed stock on a once-through operation.

In manufacturing aviation gasoline, the Avon refinery carries out the following operations:

1. Distillation of light crude oil to obtain gasoline, residuum, and intermediate fractions. The intermediate distillates form part of the charge to the catalytic cracking unit.

2. Superfractionation of straight-run gasoline, to sift out the high octane components. The products from this unit are aviation base stocks, isomerization plant feed stocks, and solvent refining charge stocks.

3. Solvent refining of straight-run naphthas to produce additional aviation base stocks rich in aromatic hydrocarbons.

4. Isomerization of normal butane to increase the quantity of alkylation feed stocks.

5. Alkylation of butylenes, amylenes, and propylene with isobutane to produce aviation gasoline blending agents.

6. Isomerization of normal pentane to isopentane for increasing the supply of aviation gasoline blending agents.

7. Thermal reforming of low octane straight-run naphthas and raffinates from the solvent refining plant, primarily to produce light olefins for alkylation feed stocks and charging stock for aviation base stock production by Fluid catalytic cracking.

8. Thermal cracking of reduced crude and gas oils.

9. Thermal polymerization of refinery propane fractions under conditions suitable for production of alkylation feed stocks.

10. Fluid catalytic cracking of gas oils and reformed naphthas.

11. Sulphuric acid treatment of both light and intermediate catalytic aviation base stocks, followed by neutralization and rerunning.

12. Blending of these and other aviation gasoline components into 100-octane aviation gasoline.

Maximizing Output from Wartime Plants Heads Refiners' Program for 1945

(*Continued from p. R-164*)

with a capacity of between 15 and 20 b/d of liquid oil output, are in operation developing information as to engineering data for large plants, yields, costs, and commercial feasibility of such operations. There is even some thought that plants may be designed to be economical under present day or immediate postwar conditions. It is quite possible that all the research and development activities known to be under way now may lead to definite and encouraging conclusions during the coming year.

Crude Oil and General Products

Charges of crude oil to stills increased to unprecedently high figures in 1944.

Compared with an average of about 4,200,000 b/d in December, 1943, we have a figure close to 4,600,000 b/d average in December, 1944. The 1943 year's average of approximately 3,910,000 bbls. is exceeded, as will be shown when final figures are available, by about 600,000 b/d for a 1944 average of approximately 4,525,000 b/d. Doing this cut into the country's over-all crude oil stocks by about 20,000,000 bbls.

Motor gasoline rationing continues. Transportation difficulties decreased to some extent but increased diversion of petroleum products to war purposes prevented any easing up of gasoline rationing. Daily military uses of gasoline have increased by more than 200,000 bbls. to a total of more than 800,000 b/d, so it has taken the increased refinery runs and the somewhat greater transportation capacities to avoid the necessity of still further reducing gasoline for the public. The situation is not likely to change until at least the European war is ended.

Tetraethyl lead for gasoline again developed into a problem. The great quantitative increase in 100-octane gasoline with its 4.6 cc's. per gallon consumption (with much of it at 6 cc's. per gallon for several months), as well as increased quantities of other war gasolines, made it necessary to restrict the use of lead materially in civilian gasoline, thereby reducing the quantity of high octane premium grade gasoline available to the public. Production of premium gasoline was quantitatively cut in June to 50% of the base period (October 1943 to March 1944) and again to 25% of the same base period on Oct. 1. An improvement in the supply permitted raising production of premium gasoline to 37½% effective the last week in December.

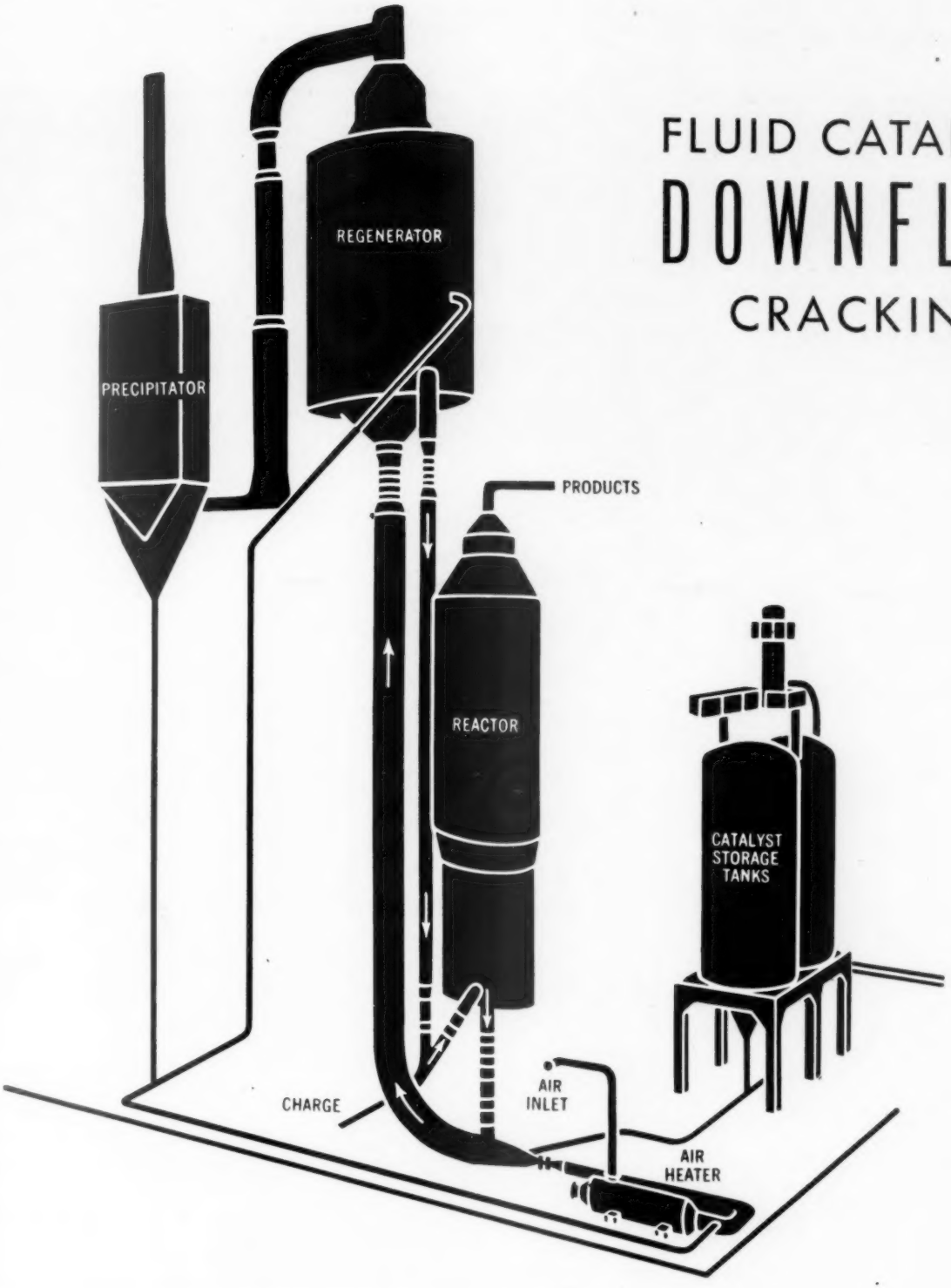
There were a few scares during the year on kerosine and the lighter fuel oils used for household heating, but the situations were worked out to the best possible degree by the control efforts of PAW with the cooperation of the industry. The expedient of shipping kerosine in drums in railroad boxcars from the Gulf Coast refineries to the New England states was again resorted to at the end of the year. Juggling back and forth between light and heavy gas oils, between kerosine and domestic burner oils by PAW and the industry will continue as needs arise.

The industrial heavy fuel oil situation is, however, considerably changed. With the high crude runs there was a natural increase of heavy fuel oil which more than over-balanced any decrease affected by catalytic cracking operations. At the end of the year there was a supply on hand of some 4,000,000 bbls. more than at the first of 1944. The outlook is for further inventory additions.

In general, national inventories of petroleum products, at the end of 1944 were in somewhat better position than the year previous, but merely enough to reduce some of the apprehension previously felt. This heavy fuel oil situation is the only comfortable product inventory picture.

There is every confidence in the industry and in PAW that we will continue to meet all demands and handle exigencies and emergencies as they arise.

FLUID CATALYTIC DOWNFLOW CRACKING



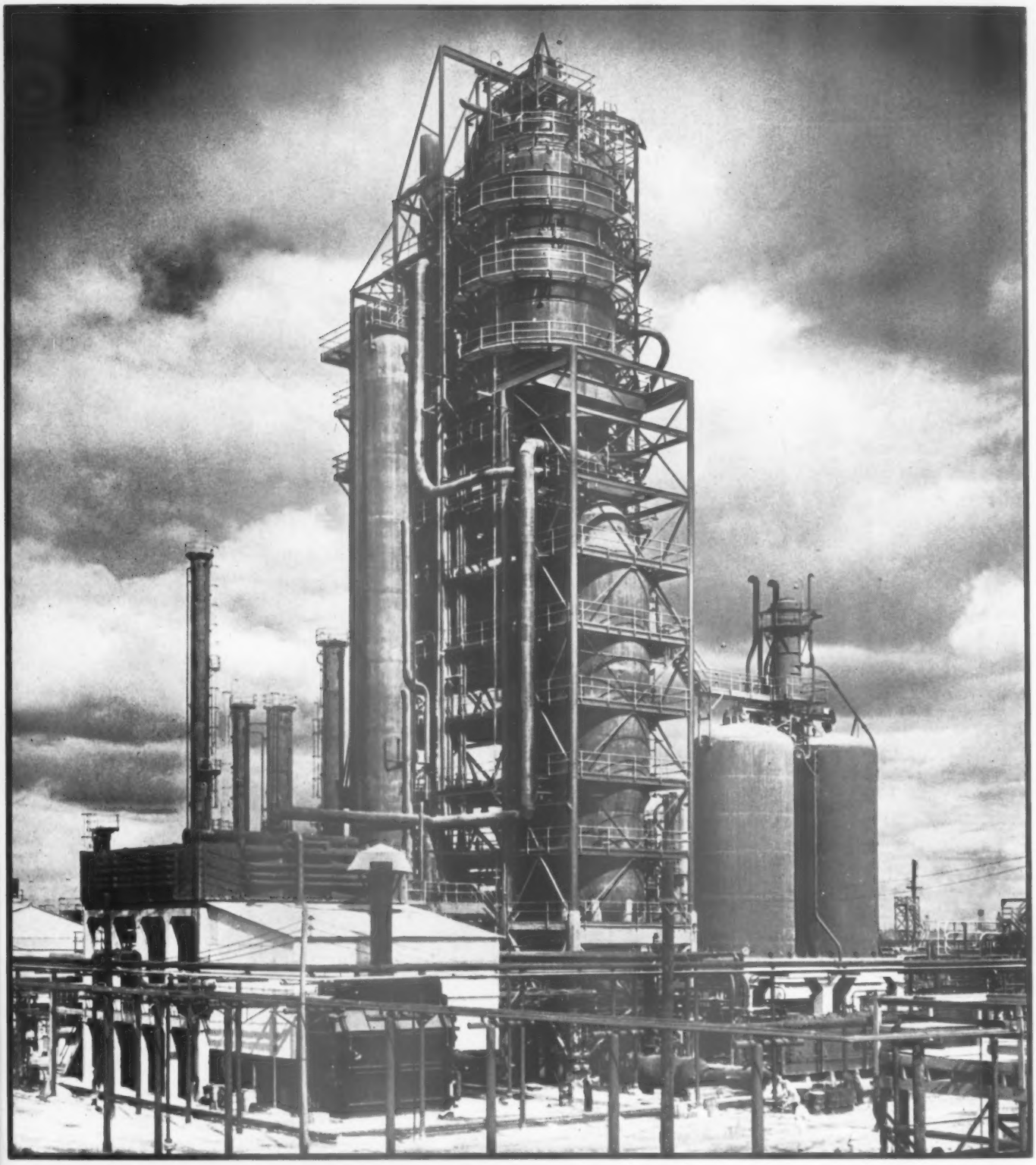
Cost per gallon of Gasoline (of comparable Octane) is the only true measure of the overall efficiency of a cracking process.

Octanes (as high as 99.8 Research)—Charges (as heavy as 90% at 1065°F.)—"Onstream" (as long as 6 months) are operating accomplishments which classify FLUID CATALYTIC "DOWNFLOW" CRACKING as the most economic method for producing HIGH OCTANE MOTOR GASOLINE.

Reprints of the technical description and advantages of this improved catalyst flow, titled "IMPROVED FLUID PROCESS FOR CATALYTIC CRACKING" by E.V. Murphree et al (presented at the November 1944 meeting of the A.I.Ch.E.) are available on request. Address Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.

FOSTER WHEELER

"Octane Independence"



Octane competition is no problem to a refiner using FLUID CATALYTIC CRACKING. Performance records covering a wide variety of operating procedure represent substantial proof, that a "FLUID" unit can place a refiner in that desirable manufacturing position of being able to meet any competitive Octane situation.

Foster Wheeler Corporation

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BAYTOWN

Superfractionator columns at Humble Oil & Refining Co.'s Baytown refinery. Each is 12 ft. in diameter and contains 50 trays.

Processes 200,000 Bbls. of Crude A Day

Humble Refinery Converts 25% of Thruput Into Aviation Gasoline, Toluene, Synthetic Rubber Materials and Other Critical Wartime Petroleum Products.

By D. P. Thornton, Jr.
Assistant Editor, NPN Technical Section

THE production of the Billionth Gallon of finished 100-octane aviation gasoline at the Baytown refinery of Humble Oil & Refining Co. was an occasion rightfully celebrated by the company the week of Dec. 14 as "B-Day." This plant is said to have produced more finished 100-octane than any other plant in the world. In addition, it has other outstanding claims to fame in its service to the war effort.

The Baytown refinery is the largest in Texas, reportedly processing more crude oil and other hydrocarbons than any other plant in the U. S. Its total input is currently in excess of 200,000 bbls. a day which represents over 4% of the total crude oil refined in this country. The toluene plant associated with it, and closely interlocked with its various units, has made more of this vital chemical since Pearl Harbor than any other plant. Its present production rate exceeds contract requirements by 140%, or more than the total toluene produced from all sources during World War I.

The 30,000-tons per year Butyl rubber plant, also associated with the Baytown refinery, is rated to provide nearly half of U. S. production of this type of synthetic rubber. The butadiene plant, another government-owned plant interlocked with the refinery and using the standard "from petroleum" process, has exceeded its 30,000 tons-a-year rating by about 50% when enough butylenes were available.

Still other parts of this sprawling giant going all-out for war are the hydrogenation plant, which produces the saturated hydrocarbons for aviation gasoline, and the alkylation plant, making alkylate blending stock. In addition, aviation lubricants are produced in quantity, likewise Navy Diesel and bunker fuel, Army all-purpose 80-octane gasoline, heavy-duty lubricants for military fuel, xylenes and other hydrocarbons for solvents and a greatly-reduced quantity of conventional refinery products when compared with peace-time volume.

Entire Refinery Interlocked

Every part of this refinery may be said to be interlocked in some fashion or another with nearly every other part. When the government-owned plants were built—toluene, Butyl rubber and butadiene—they also were fitted into this picture of mutual interdependence. Thus material rejected as a by-product from one processing area forms a part of the charge to other units. A stream from one unit may be subdivided into many streams, to ultimately find its way into one or many of the products made in the plant. Moreover, the division of that individual stream not infrequently may change from hour to hour as well as from day to day.

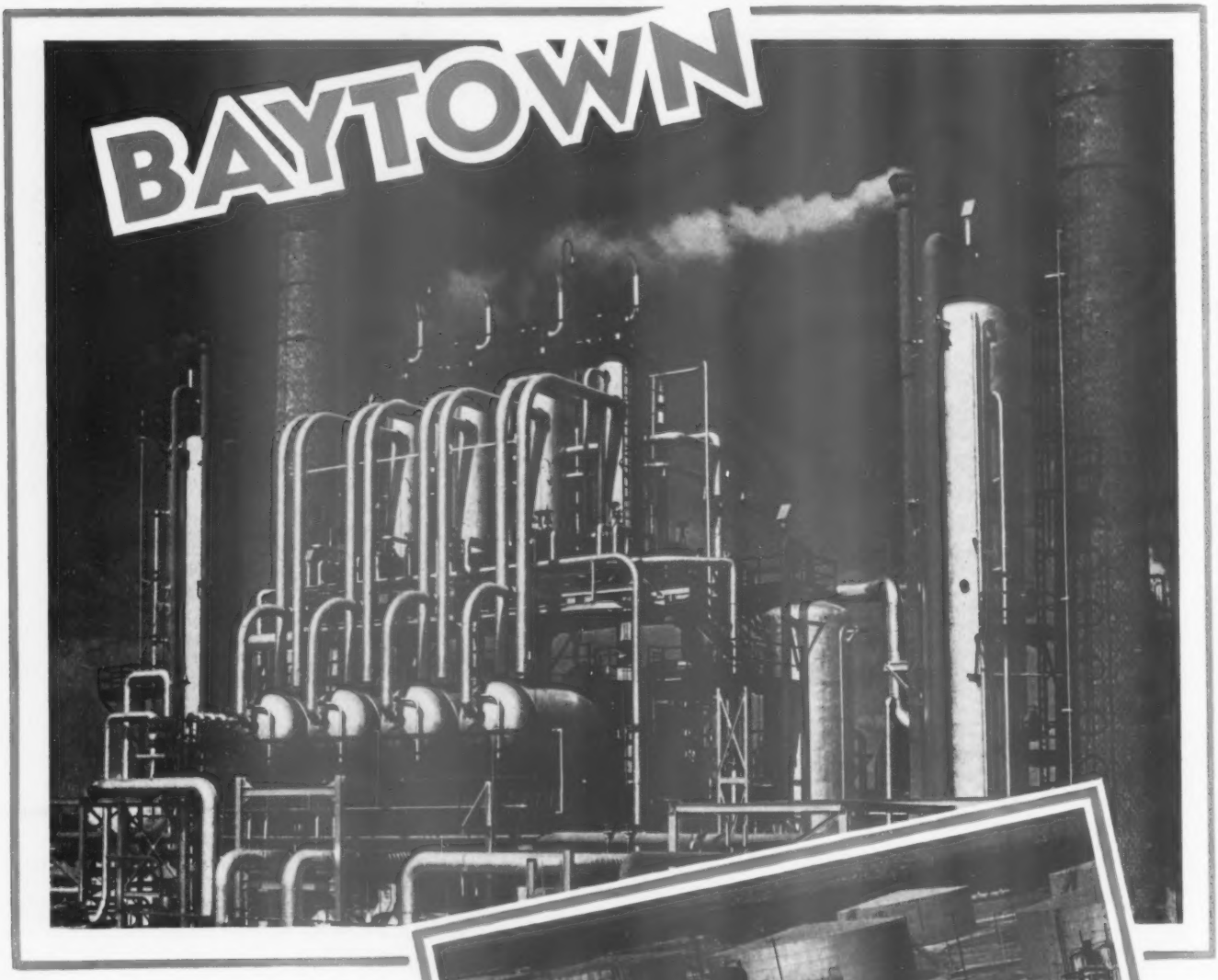
In building this plant through the years, it has been Humble Company's policy to use everything—everything in the way of processing fractions and everything in the way of equipment which, from time to time, is rendered obsolete for its original use by changes in technique or new processing methods. Thus the plant is much like Topsy, it "jus' growed."

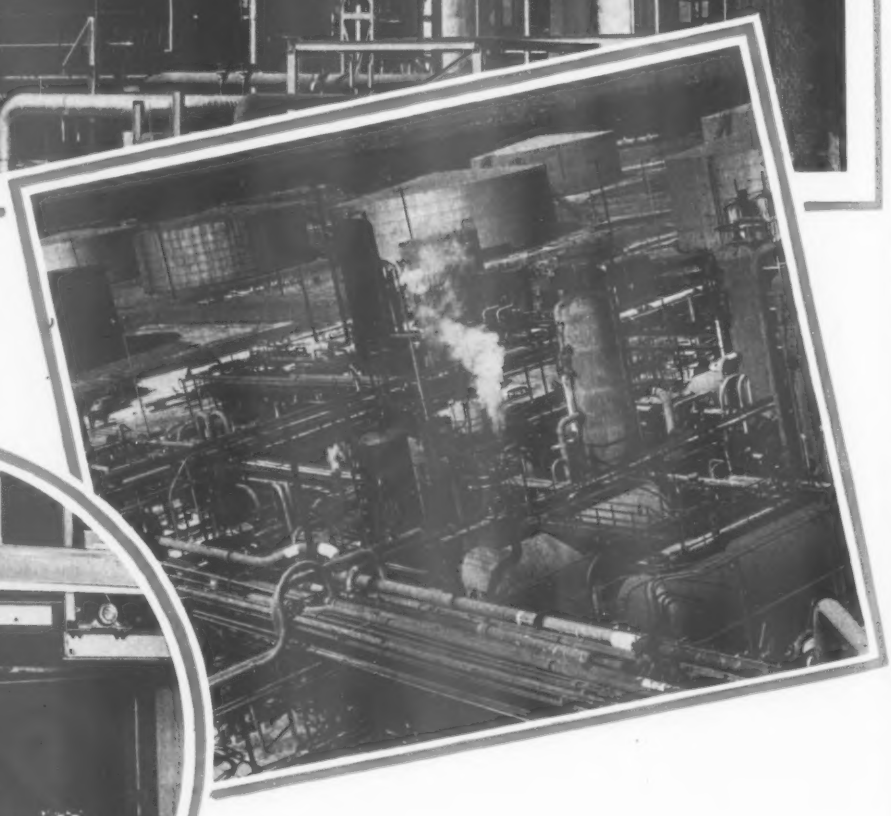
Refinery technicians say there is no one flow-sheet in existence which traces flow for all products in detail from the tank farm to the loading rack or wharf. Instead, there are a multitude of relatively simple flow-sheets, which show the processing flow and sequence for the individual product from raw charge to finishing. This has its advantages, for a left-over by-product at one unit can immediately be assigned to some other unit where it can be transformed into something salable as such or as an intermediate for still further processing. Plenty of piping manifolds are available to make the actual physical switches required by such operations.

For this reason, and keeping the reader's peace-of-mind in view, the plant description following has been limited to include only those units in the Baytown refinery making critical war products, which either are unusual in processing or construction details, and which may be discussed without violating military security requirements.

Considering the refinery as a whole, over 25.6% of its more than 200,000 b/d input goes into critical war products;

BAYTOWN

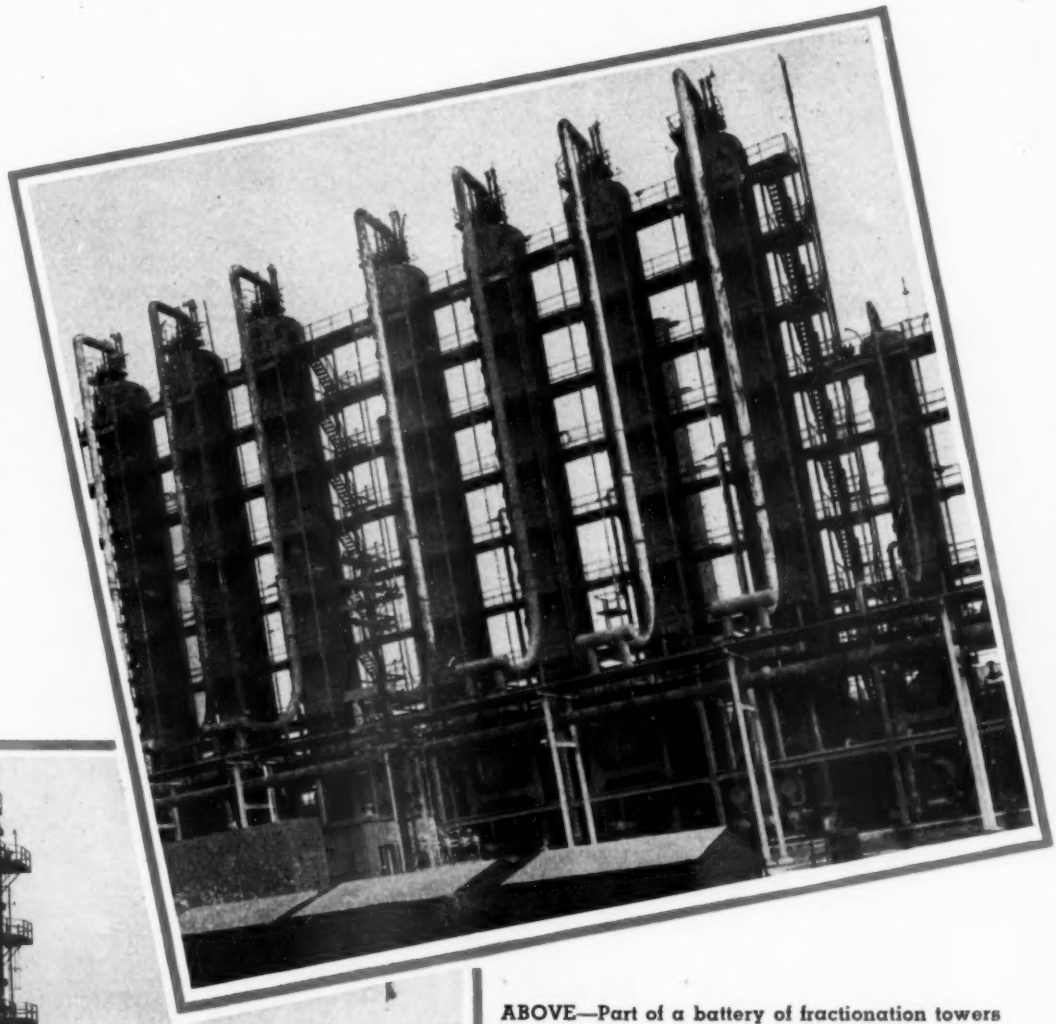




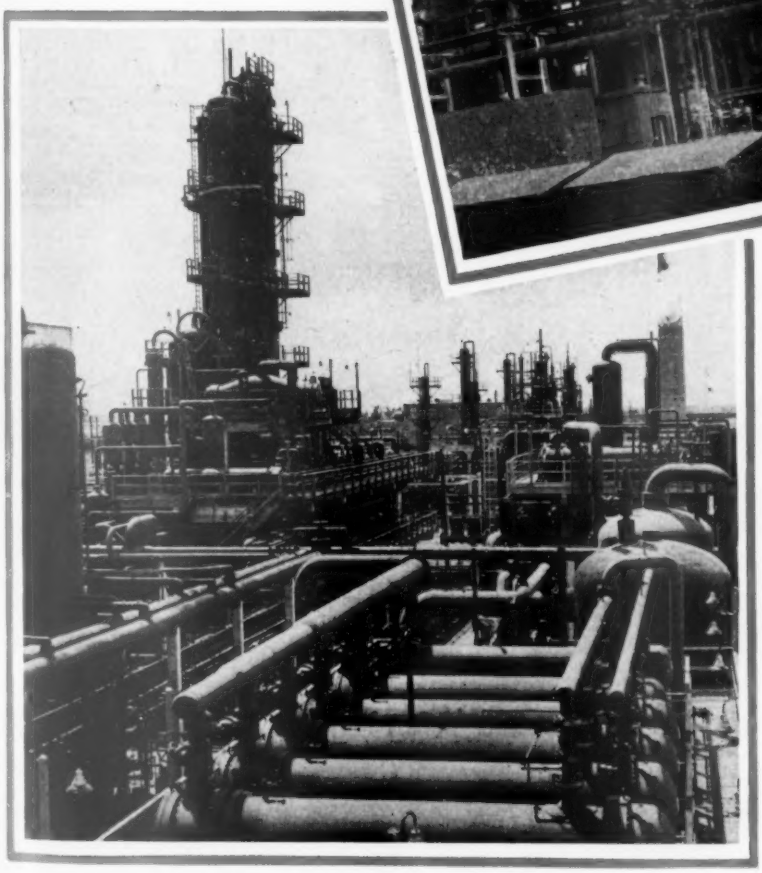
BELOW—Finished butyl rubber at the Baytown plant coming off in 14-inch strips, to be cut and packed for shipment to other plants for further processing.

ABOVE—The first commercial alkylation plant in the world, at the Baytown refinery of Humble Oil & Refining Co. It was constructed in 1938, mostly from converted equipment. Since then modern units have been installed, the plant now having five sulfuric acid units.

BAYTOWN—Where One Oil Company Processes 200,000 Bbls. of Crude a Day, Making Aviation Gasoline, Toluene, Synthetic Rubber Materials, Aviation and Heavy-Duty Lubricants, and Many Other Essential Wartime Products.



LEFT—Low-pressure catalytic hydrogenation unit at the Baytown refinery, converted by Humble's engineers from an old Cross cracking plant. The reaction is in fixed beds, charge stock being copolymer or light catalytic naphtha.

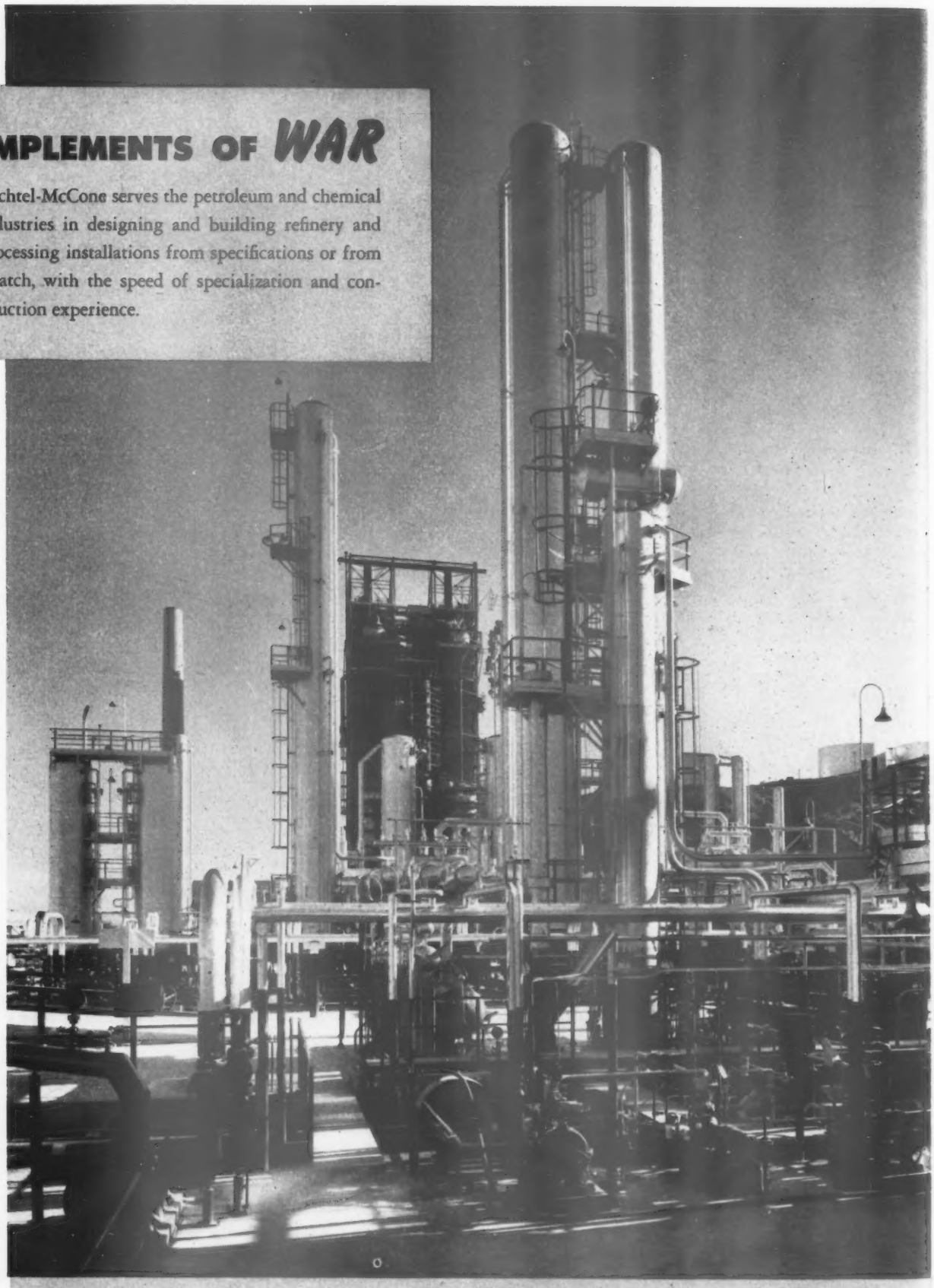


ABOVE—Part of a battery of fractionation towers at the Baytown Ordnance Works toluene plant. Toluene is made by hydroforming a cut from light crude naphtha from the pipe stills. The $12,000,000 BOW plant is owned by the Ordnance Dept., U. S. Army, and operated under contract by Humble.

LEFT—Part of the 30,000-ton annual capacity butyl rubber plant at Baytown. Manufacture of this type of synthetic rubber (from isobutylene and isoprene) was entirely developed by Standard Oil Co. of New Jersey technologists, the work starting in 1937. The Baytown plant, costing $25,000,000, is owned by Defense Plant Corp. and operated by Humble under contract with Rubber Reserve Co.

IMPLEMENTS OF *WAR*

Bechtel-McCone serves the petroleum and chemical industries in designing and building refinery and processing installations from specifications or from scratch, with the speed of specialization and construction experience.



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its payroll includes 6000 persons. The product list at this plant includes: propane, motor fuel, kerosine and tractor fuels, gas oils, 100-octane aviation gasoline, 80-octane all-purpose gasoline, aviation lubricants, heavy-duty lubricants, paraffinic and Coastal lubricating oils, fuel oils, asphalt, isobutane, hydrogenated base stocks for 100-octane manufacture, copolymer (codimer, etc., for hydrogenation at Baytown or elsewhere), toluene (for TNT, solvents, and 100-octane manufacture), xylene and other aromatic solvents, paraffinic solvents, butylenes, alkylate, butadiene, Butyl rubber and Navy Diesel and bunker fuels.

Initial refining operations are, of course, topping, followed by both thermal and catalytic cracking and supplemented by reforming and the other conventional processing to be found in most large plants for the manufacture of the usual line of refined products.

Cracking Facilities

The thermal cracking facilities total twenty 750 psi tube and tank units. Two other units, old Cross crackers, now have been diverted from thermal cracking and revamped to become part of the newly completed low-pressure hydrogenation unit.

Charge to the cracking units consists of residuum, naphtha for reforming and light cycle oil. Whatever the stream compositions are at a given time depends on what the rest of the refinery is doing. Severity of cracking is determined by over-all refinery processing needs at that time. This is followed by entirely conventional fractionation, whence the effluent streams are ready for further processing.

Catalytic cracking facilities consist of two Fluid units. The first, a Model-1 ("upflow") unit went onstream in November, 1942. It is designed for 13,300 bbls. per stream day. The second, a Model-2 (downflow) unit, designed for 15,500 bbls per stream day, was completed in February, 1944. The charge is mixed gas oil from all crude streams entering the refinery, although the Model-1 unit can charge black-oil and drop out heavy bottoms.

The Baytown refinery has capitalized extensively on the "factor of ignorance" necessarily built into all units, cracking or otherwise. Consequently, the Model-1 Fluid unit is operating at 24,000 bbls per stream day net feed to reactor, 180% of design rating, while the Model-2 is running at about 21,000 bbls. per stream day, or 135% of rating.

The operation of both these units is similar to that reported in the literature by many authorities. The only difference is that they have been continuously crowded to the limit of their capacity, and every attempt made to eliminate bottlenecks as fast as they were discovered. For instance, at one unit it has been found that the current production bottleneck is the carbon-burning capacity of the regenerator, at present limited by blower capacity. An additional blower now is on order and when installed the thruput capacity of this unit will have been substantially increased.

Another "wrinkle" used to boost thruput was the installation of a recently-developed (Standard Oil Development Co.) type of catalyst stripper in the Model-2 unit. It consists of multiple stripping sections in the reactor to increase efficiency of steam used in removing oil from the catalyst. "The less oil on the catalyst, the less load there will be on the catalyst regenerator and the more net product recovered," an engineer commented.

Synthetic Toluene Plant

Small quantities of natural toluene occur in certain petroleum naphthas and can be recovered by precise factional distillation and purification. The quantities thus recoverable, however, are inconsequential when compared with the huge quantities needed by the United Nations. This lack of sufficient volume of toluene brought into being the process of hydroforming for the catalytic synthesis of toluene developed by Standard Oil Development Co. This process has been the backbone of the oil industry's contribution to munitions and it is interesting to note that TNT produced by chemical synthesis from petroleum has supplied two out of every three bombs used during World War II.

The toluene plant, known formally by the name "Baytown Ordnance Works" and familiarly to plant personnel as "BOW", produces nitration-grade (99.0% pure) toluene for conversion into TNT. It is owned by the Ordnance Dept. U. S. Army and operated under contract by Humble.

The contract for the construction and operation of BOW was signed October 21, 1940. The first shipment was made on October 21, 1941, just 47 days before we entered the war. Meantime, this first synthetic toluene plant in the world has produced toluene for the TNT in one out of every two bombs used by the United Nations since Pearl Harbor.

Light Naphtha Charged

In operation, the charge to the BOW plant is primarily light crude naphtha from the pipe stills. This stream is stabilized to remove C_4 hydrocarbons and is then roughly split up into three fractions: a bottom fraction boiling from 270 to 420°F which is sent to the refinery for thermal reforming; the first overhead cut boiling from 200 to 270°F, which contains any natural toluene plus compounds which can be synthesized to toluene; and the second overhead cut having a boiling range of about 80 to 200°F used as charge to the superfractionation system of the refinery.

Feed for the hydroforming operation, of 200-270°F boiling range, is heated to 900-1000°F at 250 psig in a separate preheater and then charged as vapor to the reactor which has a fixed-bed of heavy metal oxides as catalyst. The reaction is endothermic and heat must be supplied to keep it going. Catalyst is notably long-lived, being regenerated as activity decreases by controlled oxidation with air. Processing is once-through, with part of the hydrogen liberated being recycled. Balance of the hydrogen is used at the hydrogenation plant.

The hydroformate stream from the reactor, after being freed of hydrogen, is split into three streams by fractionation. The light cut, quite free of olefins, after further processing is used as aviation base stock. The heavy cut is rich in xylenes and other aromatics, hence is brought back to the refinery for acid treating and rerunning to make aromatic solvents and aviation gasoline blending stock.

The intermediate cut is the toluene-rich fraction. Toluene is separated from most of the other compounds present by solvent extraction with liquid sulfur dioxide, but details of this operation are not divulged. The extracted toluene fraction then is acid treated and redistilled to meet specification nitration-grade requirements.

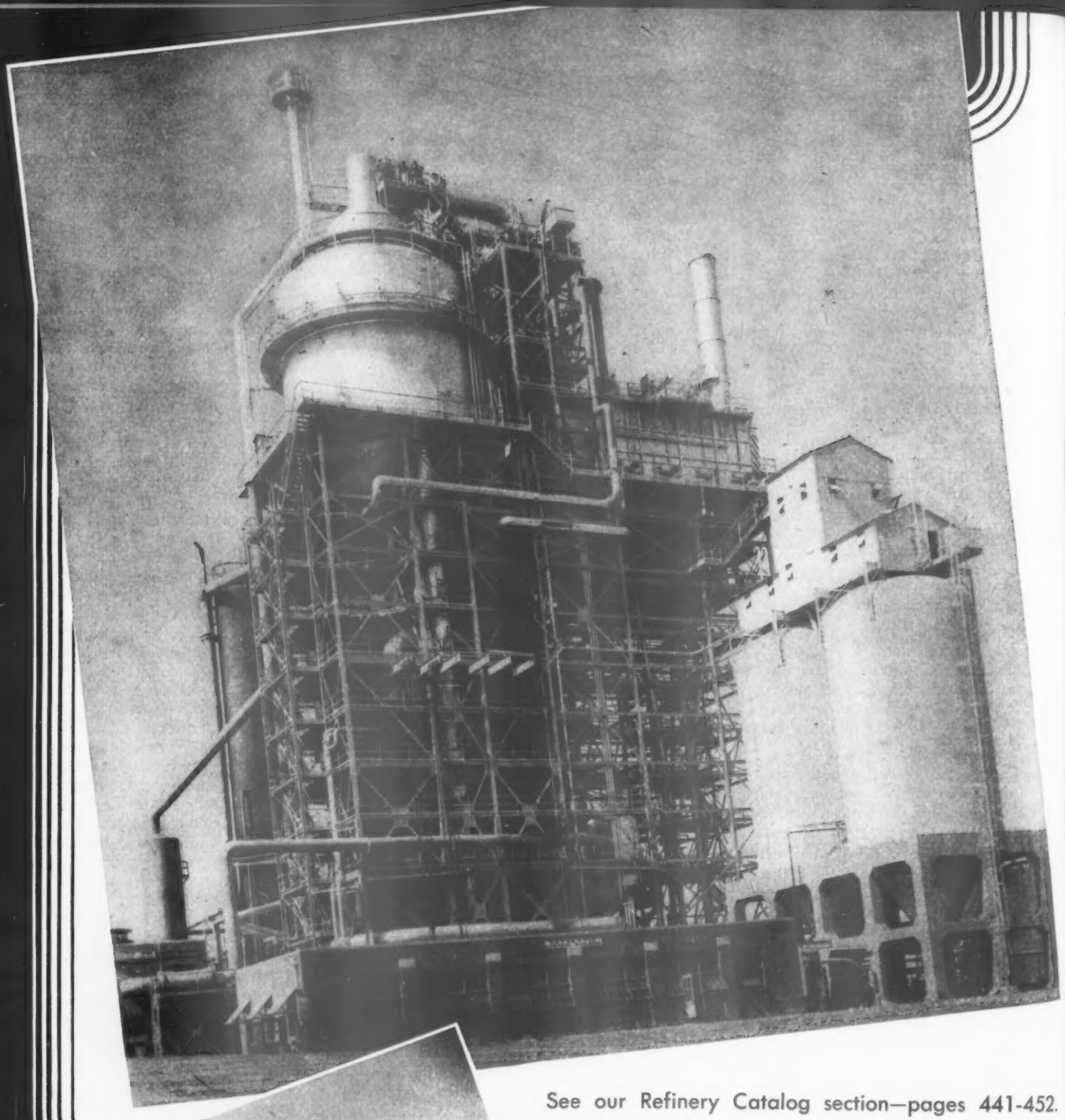
The raffinate from toluene extraction is in part recycled, while the balance also goes to the naphtha reformers. An alternative operation sometimes used ahead of reforming is to distill off a fraction used for making isooctane.

BOW's contract calls for toluene of minimum 99.0% purity. In actual practice Humble's toluene has ranged up to 99.5% pure, approximating in volume about 10% of the original volume of naphtha charged to the plant.

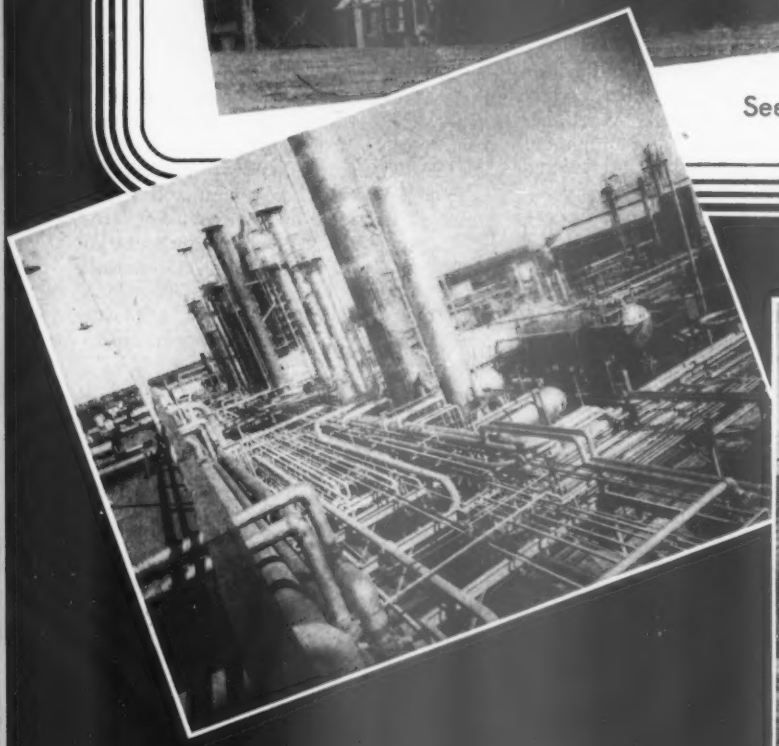
The record of production at this unit called forth from Robert P. Patterson, Undersecretary of War, the statement: "I am pleased to inform you that you have won for the fifth time the Army-Navy Production Award for outstanding service in (war) production . . . This fourth renewal is a symbol of high achievement over a long period." And from Army's Chief of Ordnance, Maj. Gen. L. H. Campbell: ". . . the Baytown Ordnance Works has maintained maximum production since its inception, producing the bulk of a most basic material of war during a period when no alternatives were possible, and without which the successful prosecution of the war would have been extremely uncertain, to say the least."

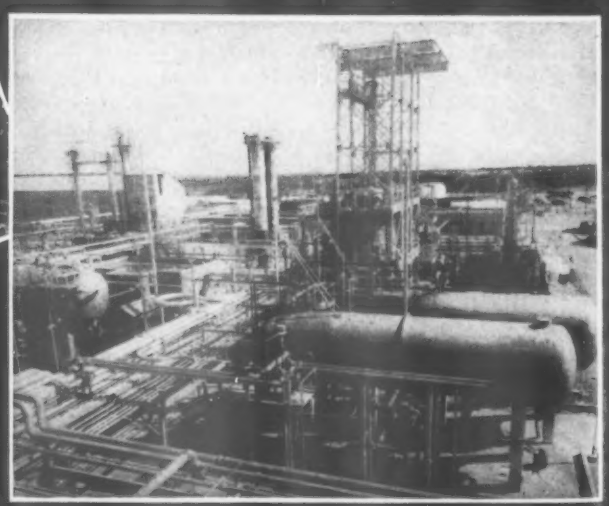
Aviation Gasoline

The Baytown refinery has produced more 100-octane aviation gasoline than any other plant in the world. Principal components of Humble's product are carefully-selected naphtha base stocks, hydrogenated catalytic base stock, hydrocodimer, alkylate, selected aromatic fractions, isopentane, isohexane and isoheptane, plus tetraethyl lead. Special processes particularly involved are alkylation (largely from amylenes), butane isomeri-



See our Refinery Catalog section—pages 441-452.





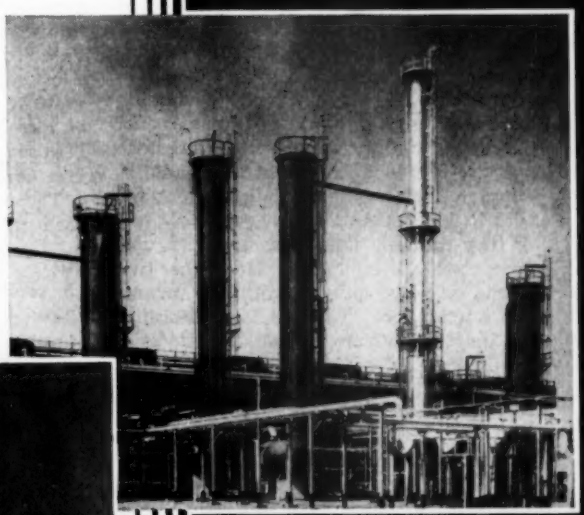
Aviation Gasoline Plants with Speed and Economy

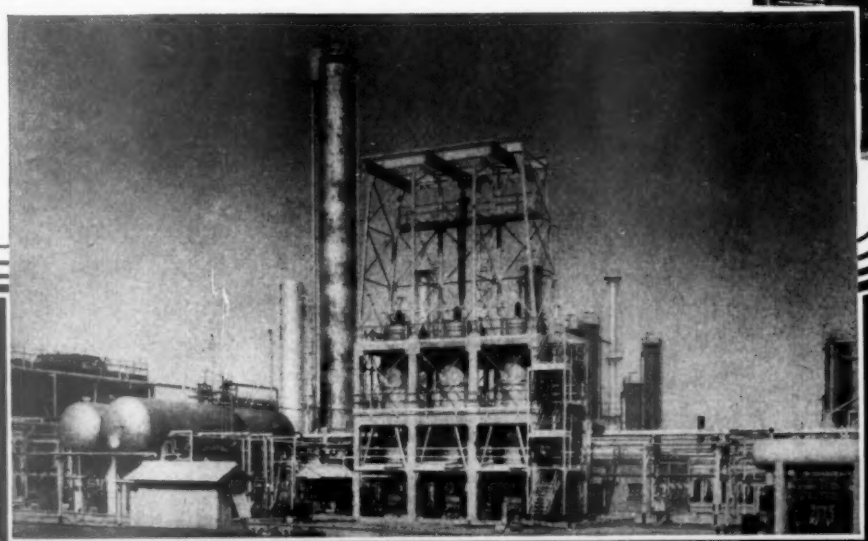
Hi-octane service in planning and building combat aviation gasoline plants has turned the eyes of the refining industry our way.

The particular job pictured on these pages was engineered and constructed for Associated Refineries, Inc. Eight companies joined in this project from which aviation fuels now flow steadily to our armed forces.

Sixty percent of our contracts during the last six years has been repeat business, clearly indicating how experienced refiners rank our Engineering and Construction Division.

We welcome inquiries, however tentative, and we are interested not only in plants "from the grass roots", as in the case of the Associated job, but in plant modernization.





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zation, hot acid polymerization, hydrogenation (of catalytically cracked base stock) and superfractionation (of straight-run naphthas).

Baytown claims the distinction of having the first commercial alkylation unit ever built, its first reactor being completed in 1938 from odds and ends of equipment on hand. Since then, 4 more reactors have been added to make a full battery of 5 sulfuric acid alkylation units. The plant is entirely conventional in construction.

Alkylate made here is mostly amylene alkylate, made from thermal and catalytic C_5 olefins and isobutane. In order to have sufficient isobutane, a butane isomerization unit using anhydrous aluminum chloride as catalyst and hydrogen chloride as a promoter was built "in a hurry" by revamping, in place, some old and temporarily idle equipment. Balance of the charge to the alkylation units consists of normal and isobutane plus normal and isobutylenes not needed at the butyl rubber and butadiene plants (and which may be diverted to codimer if desirable). The product then is debutanized and depentanized, whence it is ready for blending.

The copolymer plant uses hot sulfuric acid as a polymerization catalyst. The plant, which is entirely conventional in operation, charges a C_4 cut containing isobutylene and normal butylene not needed at the Butyl rubber and butadiene plants. The copolymer is hydrogenated to form a high octane blending agent for use in 100-octane aviation gasoline.

The catalytic light ends recovery unit processes all light ends from the two Fluid crackers, splitting out three streams by fractionation. The first cut, consisting entirely of methane, ethane and ethylene, is used as refinery fuel; the C_3 cut goes to thermal polymerization; the C_4 cut goes successively to the Butyl rubber and butadiene plants.

At this unit also, the catalytic naphtha streams are split to produce a C_6 cut with a 210°F. endpoint, which serves as charge to the low-pressure hydrogenation unit, and 210 to 400°F. cut used as charge to the thermal aftertreating unit.

At the aftertreating unit, which is a conventional thermal cracking unit, the charge is heated to 1025°F. under pressure of 750 psi. Its function is to crack the paraffin hydrocarbons away from the high aromatic content of the stream in order to prepare a high-octane aviation gasoline base stock. Following aftertreating, the product is acid treated and distilled to specification.

An old Cross cracking unit was converted into a low-pressure catalytic hydrogenation unit by Humble's engineers, hard upon the discovery that the low-pressure idea would work if a special catalyst were used. Defense Plants Corp. supplied the funds for the conversion and owns the hydrogenation facilities which Humble operates.

Roughly half of the feed stock for hydrogenation comes from Baytown and the rest from outside sources; it consists of both copolymer and light catalytic naphtha. Hydrogen used in the process comes from the dehydrogenation unit at the toluene plant (BOW) and from the butadiene plant. Hydrogen from BOW does not need purification, although it must be raised to the operating pressure of the unit, 250 psi; hydrogen from the butadiene plant is freed of carbon dioxide in a Girbatol unit.

The catalyst, a heavy metal sulfide, is used in fixed-bed reactors designed to hydrogenate approximately 8000 b/d of copolymer, or 12,500 b/d of light cat-naphthas. The reaction is exothermic, temperature of around 550°F. being employed; temperature control is by circulating cold charge stock, sufficient heat being picked up by exchange to preheat the feed stock for distillation prior to its being charged to the unit. From the reactors, the hydrogenated material goes to separators where liquids are trapped out and pumped to a stabilizer. Separator gas is used in part as recycle to the reactors, while the rest is run through an absorber where light ends are recovered in the usual manner, and thence to the refinery where it is used for fuel.

A section of the Butadiene plant at Baytown. Costing $19,400,000 it was built by the government and is run by Humble: chief raw materials come from the adjacent refinery. It has been operated at 50% above its rated capacity of 30,000 tons production per year.

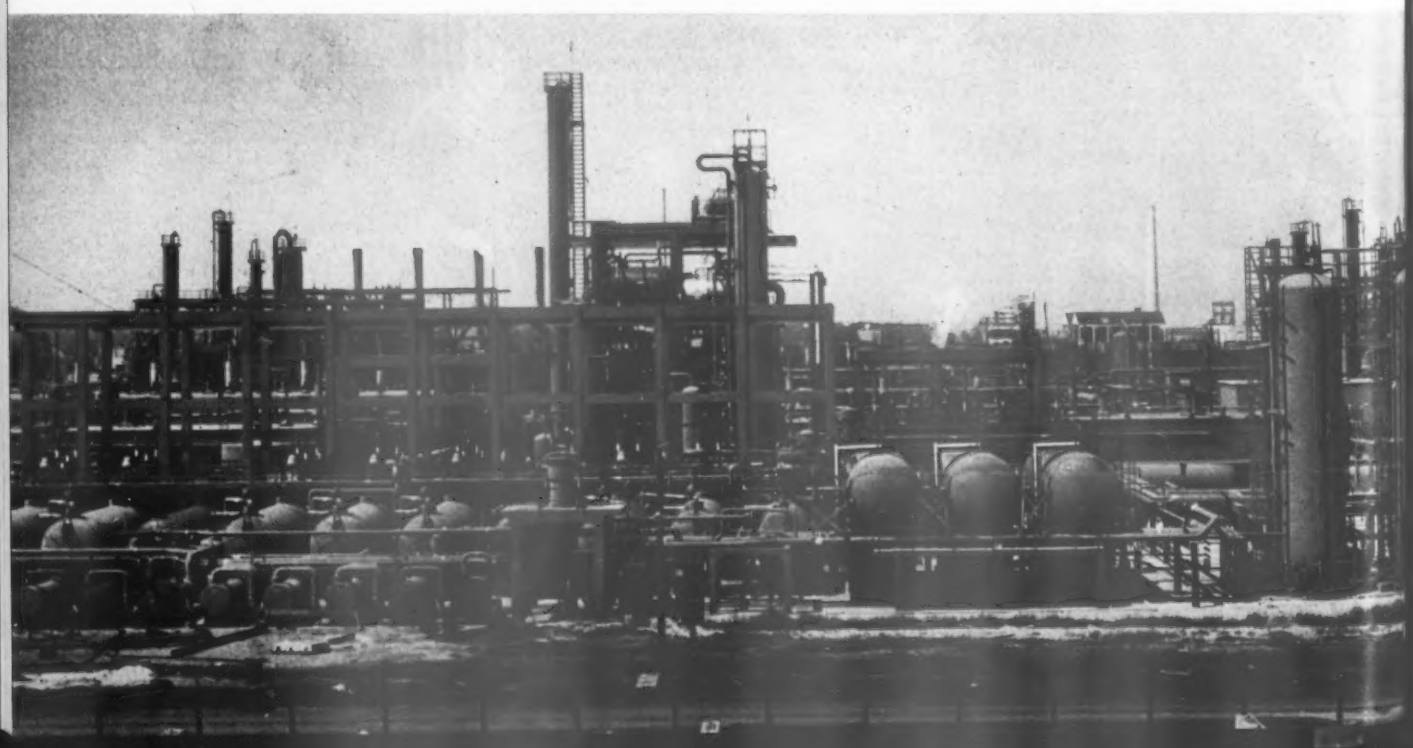
Superfractionator Columns

One of the most unique items of the refinery equipment, although perhaps the simplest in its function, are the superfractionator columns. They are, in essence, very carefully designed fractionating columns. It is possible to separate in them isomeric hydrocarbons differing only by 5-10°F. in boiling point range.

The unit consists of four towers, each 12 ft. in diameter and containing 50 trays. While there are many 50-tray towers in existence, and many with considerably more trays, they do not use the high reflux ratios (50-70,000 gal. per hour) and close temperature-differentials per tray that permits these towers to do the job of close cutting they perform. The towers are said to be so "sensitive" that 0.5°F. temperature change per tray will throw product streams "off" seriously.

Butyl Rubber

The $25,000,000 Butyl rubber plant at Baytown, having a design capacity of 30,000 tons per year, is one of two in the U. S. The plant is DPC-owned, the contract for its construction having been signed May 18, 1942 (for a 20,000 tons-a-year plant) and increase to present capacity was authorized in February, 1943.



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ENGINEERING a regenerative dryer employing a solid desiccant such as Driocel is a job for a dryer specialist who must know, among other things, exactly how the liquid or gas involved will behave.

He must be thoroughly familiar also with tower designing, methods of regeneration, drying conditions, desiccant properties, cycle timing as well as with needed auxiliary equipment.

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It is operated under contract for Rubber Reserve Co. The isobutylene extraction unit went on stream Feb. 16, 1944, and after many delays caused by priorities, design changes, and unforeseen developments, the first 50-lb. boxes of Butyl rubber were ready for storage Sept. 9, 1944.

Butyl rubber differs markedly from the other synthetic rubbers not only in raw materials but in manufacture and properties as well. In essence, it is a copolymer of isobutylene and isoprene, brought about under very low-temperature conditions with a special catalyst. Humble supplies the isobutylene required but the isoprene is purchased. Operations at the Humble-run plant are divided into three sub-plants: the isobutylene extraction unit, the rubber polymerization unit and the finishing unit.

Feed stock for the extraction unit consists of the C_4 cut from both thermal and catalytic cracking operations at Baytown. It is introduced into two cold-acid reactor drums, meeting a counter-current stream of 65% sulfuric acid. Isobutylene is absorbed by the acid as a loose complex, being subsequently recovered upon diluting the acid with water and heating the mixture. The diluted acid then is reconcentrated to original strength in an evaporator and returns, as a closed cycle, to the reactor drums. Straight-chain butylenes are left untouched by this operation, and serve as charge to the butadiene plant.

The liquid isobutylene then is mixed with 2½% by volume of isoprene and further mixed with a diluent before the stream enters a series of coolers where it is chilled to —140 to —150°F. by the evaporation of ethylene. The ethylene itself, supplied by Rubber Reserve, must first be pre-cooled with ammonia before it can be liquefied. It takes 21 large compressors to handle the ethylene used.

After chilling, the mixture enters the refrigerated reactor where the same temperature is maintained, is mixed with a jet-injected liquid catalyst, and the whole kept constantly agitated. While flow through the reactor is continuous, unique in the manufacture of synthtic rubber, the draw-off rate is so-regulated that residence-time is approximately 30 minutes.

As the slurry of liquid diluent, catalyst, unreacted isobutylene and isoprene, along with crumbs of Butyl rubber polymer leaves the reactor, it is dumped into a large tank containing water at 150°F. This inhibits the action of the catalyst and liberates unreacted materials and liquid diluent from the Butyl crumbs. Butyl then is ready for drying and finishing, while the unreacted materials and diluent are dried and then fractionated to separate the isobutylene, isoprene and diluent.

The process of "flashing" reactor effluent is perhaps one of the most critical in the entire operation, and is an expensive part of the operation since it is impossible to recover any of the refrigeration by heat-exchange with incoming charge or other material, as is so common to most other refinery operations.

In the finishing plant, Butyl rubber slurry is converted into finished sheets by a series of operations all designed to remove water. The slurry goes first to filters which suck the water from the particles. After the series of filtering operations the rubber crumbs are spread on the slowly-traveling belt of hot-air tunnel driers maintained at a temperature of from 200-300°F., depending on the moisture content of the crumbs. It emerges from the drier as a fairly-dry cake, to be broken up in hammer-mill breakers before traveling to the extruders.

In the extruders, which resemble huge meat grinders, still more moisture is removed by heat and pressure and the Butyl emerges like spaghetti. The rubber from the extruders is charged to heated 100-inch roller mills, thence to 60-inch finishing mills, where it finally emerges as a ribbon 14 in. wide. The ribbon of rubber then passes through a cooling machine and then to a cutting machine, where it is cut into 14-in. squares, ready for packaging into boxes which contain exactly 50 lbs.

Butadiene

The Humble-operated, government-owned butadiene plant at Baytown cost $19,400,000 and was designed for 30,000 tons per year. It was one of the first large units completed by the petroleum industry, took more than 15 months to build and has produced about 32,500 tons of "specification" butadiene since being placed in full operation August 14, 1943. It has exceeded rated capacity by about 50% when sufficient butylenes were available, all output going to the adjoining government-owned copolymer plant where GR-S rubber is made for Rubber Reserve Co. by General Tire & Rubber Co.

All the C_4 cut from which isobutylene has been removed at the Butyl rubber plant serves as charge for the butadiene plant, which also is divided into three units consisting of feed preparation, dehydrogenation, and extraction and purification. Initial operation is that of extraction, using acetone as the solvent, wherein normal and isobutane are discarded as raffinate for alkylation and other processing at Baytown and the butylenes retained as extract.

The butylenes are charged to the dehydrogenation unit, in which there are two identical pair of reactors, each pair having a rated capacity of 15,000 tons of butadiene annually. The reaction consists of mixing the butylenes with superheated steam and passing the mixture through a catalyst which removes two atoms of hydrogen from each molecule of butylene. The process has been described in an earlier issue of this magazine (*NPN Technical Section, March* 1, 1944, *p.* R-121).

The reactor effluent first passes through fractionation equipment, where water, hydrogen and light hydrocarbons are removed and then passes through a series of 10 countercurrent extractors, where the butadiene is removed by a solvent, leaving unreacted butylenes which are recycled to the dehydrogenation unit. The hydrogen is returned to the refinery for use in naphtha hydrogenation. The extract of butadiene is re-distilled to yield a product containing 98.5% butadiene or better. Some of the unreacted butylenes, about 5% by volume on the charge to the dehydrogenation unit, are continuously purged out of the system i order to prevent accumulation of impurities which might poison the catalyst or contaminate the finished butadiene. This material is returned to the refinery along with n- and i-butane and charged to the alkylation plant.

Another butadiene plant, although of smaller capacity, is located at Humble's refinery at Ingleside (near Corpus Christi), where butadiene is made by cracking heavy naphtha at very high temperatures. This unit was constructed largely of second-hand and revamped equipment—much of which came from Baytown, nearby gasoline plants or idle Ingleside units. It is an interesting sidelight on what can be done by sweat, ingenuity and determination.

The Ingleside butadiene plant includes a manufacturing unit, a recovery and fractionation unit, and an extraction unit. Cracking coils were remodeled to become the manufacturing unit. The gas plant was transformed into a recovery and fractionating unit. An uncompleted alkylation unit with the addition of various odds and ends from Baytown, several natural gasoline plants and shut-down refineries in the area, was made into an extraction unit. Two pumps out of a total of 61 were acquired by priority, the rest came from stock at Baytown and Ingleside. Only 212 hp of steam turbines were bought new, the remaining 850 hp. being supplied from stock. Of 4000 hp. required in compressors, one 300 hp. machine and spare parts to recondition another were bought with priorities; 330 hp. in electric motors was acquired the same way, 1094 hp. was supplied from stock. More than 2300 tons of steel were used, yet only 650 tons came from suppliers' warehouses. The plant went into operation in October, 1943.

Humble employes are justly proud of the splendid records being hung up daily at Baytown and Ingleside. The war effort can be justly proud of them.

Order Reprints Promptly

Inquiries for reprints in quantities of articles appearing in NPN's Technical Section should be forwarded promptly after receipt of the issue, by telegram if possible. Present conditions make it impossible to hold the type in the forms after the issue has been published and reprints ordered after the type has been broken down have to carry the additional cost of resetting the article.

New research Laboratory of Phillips Petroleum Co. at Phillips, Texas

Cutting the Lag Between Research And Commercial Refining

New Laboratories of Phillips Petroleum Co. Provide Ample Pilot Plants and Other Modern Facilities for Study of Synthetic Rubbers and New Petroleum Products Which Will Materially Shorten the Periods Required for Development Work.

ANOTHER figure in the tapestry of research the petroleum industry has been weaving to speed development work is nearing completion at Phillips, Texas. Here Phillips Petroleum Co. is putting the finishing touches to new laboratory and pilot plants.

Facilities include a main laboratory building covering approximately 13,000 sq. ft. of floor-space, an Ethyl blending plant, warehouse, and three pilot plants for the development of synthetic rubber polymerization, Philblack (carbon black) and other products. Facilities for the manufacture of pure individual hydrocarbons are already in operation.

Also located within the pilot plant-laboratory area is a commercial scale plant which has been classified by the Rubber Reserve Co. as a standby plant important to the nation's synthetic rubber program. The product of this plant, which currently is covered by secrecy orders, may be described only as a "special chemical" used in the preparation of synthetic rubber. Locations of three more pilot plants, for purposes to be announced and as yet known only as plants "X", "Y" and "Z", have been staked out.

The newly-installed facilities are to be devoted in general to pilot plant work rather than basic research, since the latter will continue to be covered at the main research laboratories (Bartlesville) and, to some extent also, at the various refineries and natural gasoline plants owned by the company. This is the reason for locating the new installations at Phillips, convenient to the nearby Borger refinery and plants producing natural gasoline, liquefied petroleum gases, channel and furnace types of carbon black, and a Phillips-operated government-owned butadiene plant. Also close at hand is the Goodrich-operated government-owned GR-S synthetic rubber plant.

Large GR-S Testing 'Lab'

An important feature of the modern, two-story laboratory building is the amount of space and the diversified equipment given over to the testing and evaluation of carbon blacks and GR-S rubber. This laboratory is intended to serve for investigations of both products. All the building will ultimately be air conditioned. The outer wall-space of each "outside" room is a band of glass brick, relieved by plain glass windows for good lighting.

The synthetic rubber laboratory section is specially air conditioned. It is divided into three rooms; an analytical testing laboratory, a sample compounding room and a service testing room. Equipment for vulcanizing and moulding test samples is located in this latter space.

The analytical testing laboratory contains equipment for physical and chemical tests of raw and compounded rubber as well as carbon black. Various tests on these products are run here, including moisture content, fatty acid, free sulfur (in vulcanized samples), rate and state of cure, and tar content of carbon blacks. Provision for testing of raw materials such as butadiene, styrene and milling and compounding additives, also is included.

Elsewhere in the room are located two tensile strength testers, with which this property may be determined at room (about 78.8° F.) and elevated (200-210° F.) temperatures; apparatus for determining torsional hysterisis (Goodrich Flexometer), or heat build-up in cured samples under conditions of rapid flexing; a device for determining the rate of retraction (rate approximates 100 mph), a measure of relative plasticity and elasticity; and electronic instruments for measuring dielectric constant and electrical conductivity.

In every case, equipment for physical and chemical tests of raw and compounded rubber is designed, insofar as possible, to take the human element out of the determination. Photoelectric color comparators are used in titrations, photocells record the rate at which samples "snap back" after extension, automatic recorders plot the data used in tensile strength measurements, electronic equipment measures electrical properties of the samples, thermocouples measure temperatures, automatic timers and other equipment record other data, and so on.

Two of the most readily apparent properties of synthetic rubber currently differentiating it from the natural variety are its lesser ability to "bounce back" when dropped or stretched, and its increased tendency to build up internal heat under rapidly alternating motion. Combined with these are its tendencies to not adhere to itself and to be affected by various weather conditions. Many if not all of these characteristics may be overcome by adding various materials,

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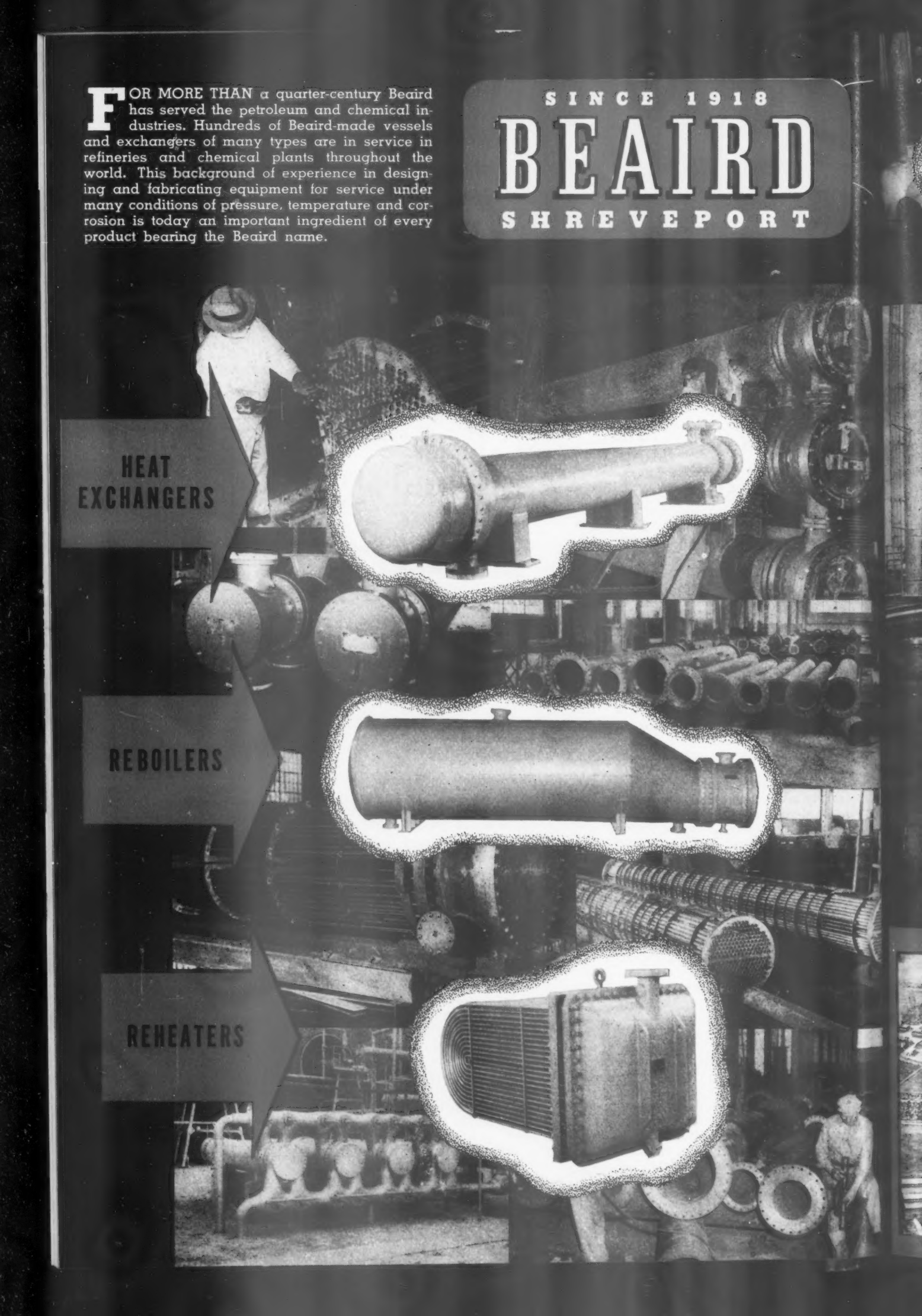

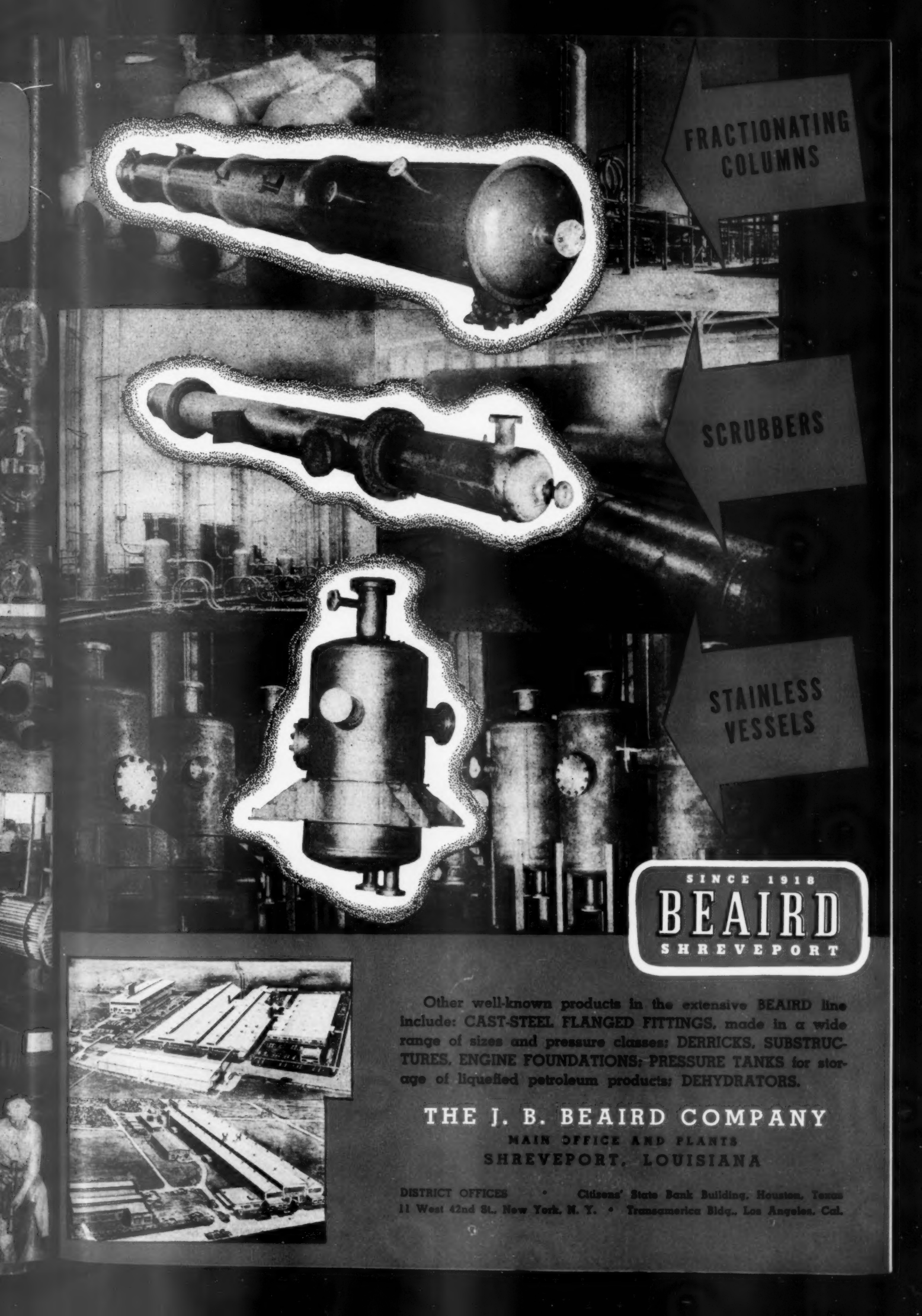

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notably sulfur compounds and carbon black, as well as by variations in conditions and reagents used in the copolymerization of the raw materials—butadiene and styrene. Thus the necessity for laboratory equipment to evaluate the effect of various components on the final product. However, and unfortunately from the standpoint of time and expense, the final deciding vote as to the relative usefulness of these products must be cast by full-scale road tests of the finished product in actual service.

In the milling and compounding room, raw rubber crumbs are mixed with appropriate amounts of sulfur, carbon black, and various fillers and additives which impart toughness, abrasion resistance, oxidation resistance and a host of other properties. These machines are for the most part semi-commercial in scale and equipped for external heating or cooling. This room also contains an extruder, which permits investigations of the problems in this type of rubber manufacture in terms of the additives and cures necessary to prevent tearing and other complications.

"Master Batch" Assures Even Dispersion

A new development in compounding which has been recently announced for commercial plants is followed here; namely the preparation of a "master batch" which contains relatively large amounts of the additives in a high degree of homogeneous dispersion. A carefully determined amount of "master" plus raw rubber then may be milled to produce a final sample which will have just the right proportion of each ingredient. This procedure, rather than just dumping the whole mix in the mill at one time, is desirable because quantity ratios of some of the additives, with reference to raw rubber, are frequently vanishingly small especially in experimental batches, and thus are not homogeneously dispersed, giving rise to serious complications in service. (*For further discussion of this subject, see Jan. 3, 1945 Technical Section, pp. R-3-6.—Ed*).

In the service-testing room in the synthetic rubber section of the laboratory, in addition to semi-commercial scale vulcanizing equipment, apparatus is provided for three severe tests for synthetic rubber samples. These are weathering, abrasion and flexing. In vulcanizing, standard sheets 6 in. square and 0.075 in. thick are prepared, each bearing identification symbols or numbers. Samples for the abrasion test, however, are rings 3 in. O.D., 1.5 in. I.D. and 0.75 to 1 in. thick.

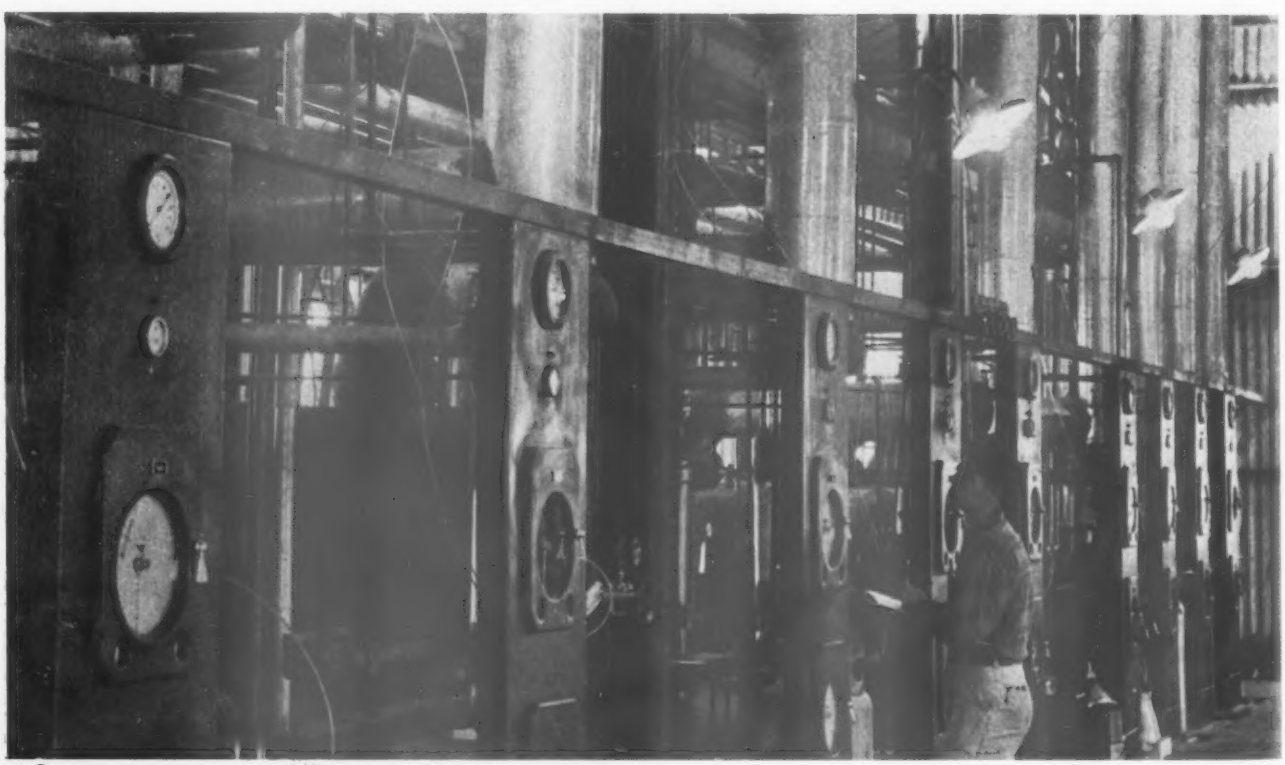
In the weathering machine the sample may be submitted to ultraviolet light of the appropriate wave lengths; it may be heated or cooled to simulate service conditions, and be tested in artificial rain. Cycles are controlled automatically. The flexing machine flexes samples under high speed conditions at controlled temperatures. Samples are punctured at several points to control the location where cracks form. The abrasion test wears out the samples on a revolving carborundum disc. Pressure of the rubber rings on the abrasive, their plane of rotation with respect to that of the stone, and speed involved may be varied at will. Test is made at room temperature.

For some time the Phillips Petroleum Co. has been conducting four programs of road tests on tires made of GR-S. A fleet of six vehicles is in use and, to date, some 35,000 miles has been covered by some of the equipment. Some of the material tested in the future will be rubber made at the pilot plant at Phillips laboratory and compounded in the laboratory mills. In tests so far, half the threads have contained Philblack, the other half being compounded from other types of blacks.

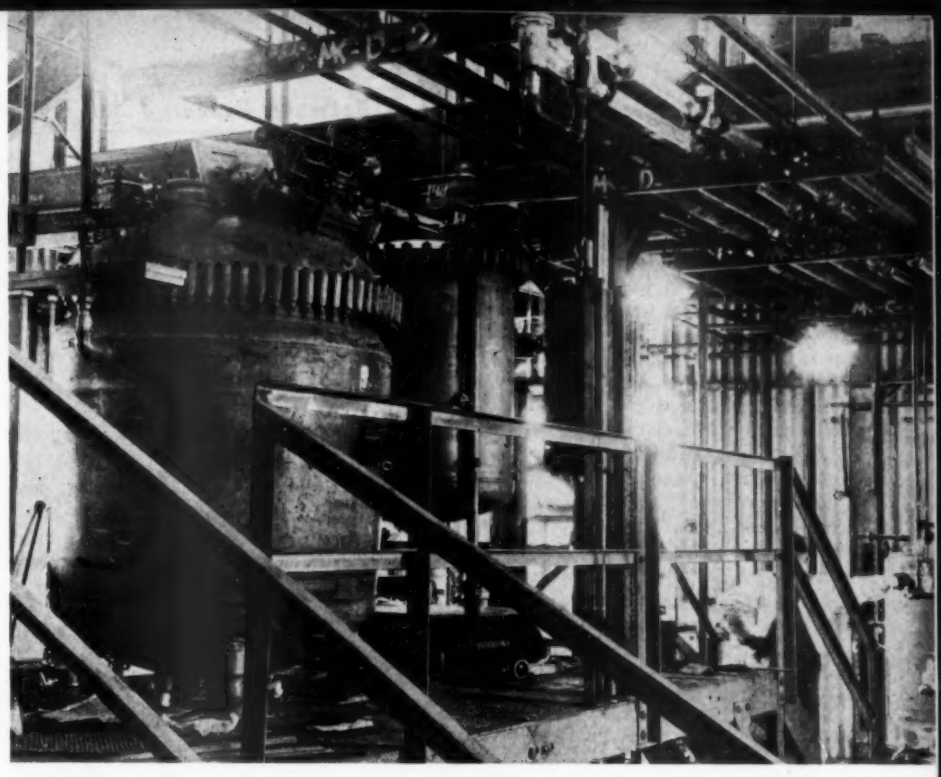
The balance of the laboratory building is given over to a storeroom, offices, a library, several conference rooms and analytical and research laboratories. These laboratories contain facilities for knock-testing (two CFR test engines), and for research on synthetic rubber and carbon black (in addition to those already described). There is also provided a profuse array of precision fractional distillation equipment, spectrometric apparatus, and laboratory scale facilities for the production and testing of various petroleum products, including those from such catalytic operations as Phillips' Cycloversion catalytic cracking.

Manufacture of Pure Hydrocarbons

Some 19 regularly-stocked hydrocarbons, ranging from methane to heptane and toluene, plus four or five others in very high purity, several hydrocarbon mixtures, ASTM precipitation naphtha, ASTM dilution naphtha and three grades



Equipment for the production of high purity hydrocarbons included in the research facilities of Phillips Petroleum Co. Shown above are a few of the 23 distillation columns installed; still pots are behind the columns. Steel construction is used throughout to eliminate possibility of explosions through formation of copper acetylide



Reactors in the pilot synthetic rubber polymerization plant are full-scale and glass lined. Some of the pipes at top of the photograph are of glass, good for 175 psi pressure

of petroleum ethers of commercial purity are made in the pure hydrocarbon plant. Also, from time to time, "special" runs are made to fill orders for other products not ordinarily stocked. This section of the general research facilities has been in operation for some time.

Hydrocarbons are regularly stocked and are available in one or more of four grades: "research," "pure," "technical" and "commercial.". The "research" grade hydrocarbons range from less than 0.01 to 0.7 mol-% total impurities, generally below 0.3, each lot being certified as to amount and probable identity of impurities. "Pure" compounds have a guaranteed minimum purity of 99 mol-%. "Technical" grades have a guaranteed purity ranging from 90 to 95 mol-%, as specified for each product. Prices range from 15 to 30c per gram for "research" grade, 50c to $6 per lb. for the "pure" grade, 10c to $5 per lb. for "technical" and 40c to $1.20 per gal. for "commercial" grade hydrocarbons. Shipment is in glass bottles, drums, ICC-approved cylinders or tank cars, depending on quantity and product.

Phillips' production of high purity hydrocarbons is an outgrowth of laboratory needs for such products in research and control work. Originally intended to supply only company needs, production facilities were gradually expanded to fill inquiries from other oil companies and government agencies. The hydrocarbons are used as reference standards in check-testing of process streams in butadiene production and in testing blending agents for aviation gasoline manufacture. Used in conjunction with newly developed spectrometric methods of analysis, they provide a basis of comparison that is many times faster than older analytical procedures.

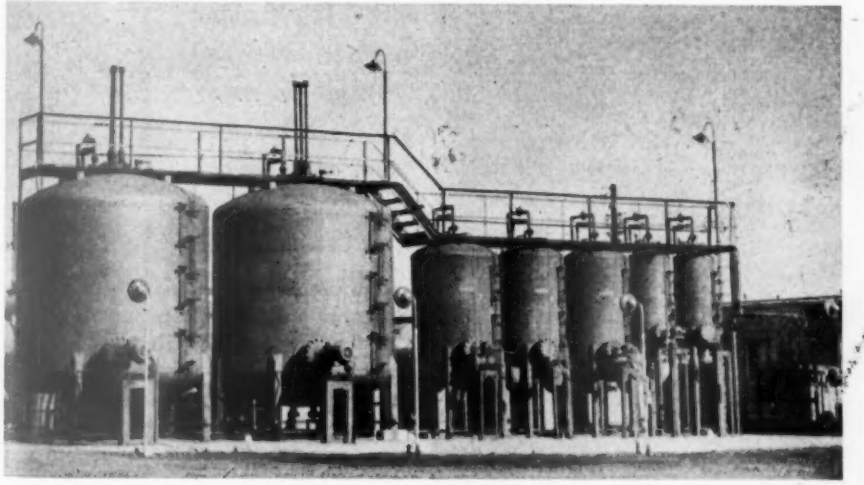
Blends of these pure hydrocarbons have been used in research investigations of aircraft fuels for the Army, and more are contemplated. In this connection, Phillips has been operating a "sky lab" for the past three years, under contract with the Army Air Force. This laboratory is a large plane fitted with newly developed and highly specialized testing and recording instruments. The engine behavior as affectted by variations in the fuels has been the subject of study. Fuels employed are complex blends from a variety of sources, the preparation of many being greatly facilitated by the availability of relatively large quantities of pure hydrocarbons.

11 Columns Now in Use

The equipment used in the manufacture of these high purity materials is semi-commercial in size, consists of 11 columns now in use with 12 more scheduled for operation shortly. It is not nearly so impressive to the observer as the purity of products produced. All columns are approximately 37 ft. high, range in diameter from 10 in. down to 4 in.; all are packed with ceramic shapes. Still pots range in capacity from 20 to 1000 gal.; operating pressures on some columns are as high as 800 psi, others 400, but the general working pressure is ordinarily 175 psi. Heat is supplied by low- and high-pressure steam coils. Reflux cooling is attained with water, kerosine, liquid propane and solid carbon dioxide, depending on condensing temperature required for the overhead product.

Columns are of steel, with reflux coils and take-offs of the same metal to avoid possible disastrous consequences from formation of copper acetylides should acetylene or other alkyne homologues be present. Very high reflux rates and precise control of temperature and distillation rate are attained by commercial control instruments, modified as required. "Technical" grade hydrocarbons, sold as such, provide the working stocks for production of "pure" and "research" grades.

Aside from refinements in operation required by the high degree of purity in



View of Ethyl blending plant (right) and part of the pure hydrocarbon storage. At extreme right, in the small building, the Ethyl fluid is metered into any one or all of the blending tanks, center. Agitators, electrically-driven, may be seen at the bottom of the blending tanks

the final product, operations are entirely conventional. Charge stock consists of product streams from refinery or natural gasoline plant whose boiling range encompasses that of the products desired. For example, a C_4 cut may contain butadiene, iso- and normal butane, and any or all of the three butylenes. This would be batch-distilled and the various fractions redistilled until products of desired purity are attained.

When the Phillips company was requested by governmental agencies and industry to provide a number of these compounds of extraordinarily high purity in larger volumes than for the usual laboratory supplies in the wartime emergency, the assignment was completed on those products most urgently needed in record time because of the 15 years experience of the company in the laboratory small scale production methods.

GR-S Pilot Plant

The rubber copolymer pilot plant, located in the general laboratory area, in many respects is fullscale as far as many of its different items of equipment are concerned. It can turn out a single batch of raw synthetic rubber sufficient in quantity to permit required laboratory evaluation tests and also to manufacture a number of experimental tires of varying sizes. In conjunction with this plant, a small pilot control laboratory is maintained which has small versions of the equipment to be found in the larger installation. Both are complete except for milling equipment.

The copolymer plant is housed in a two-story building. Its distinguishing feature is the construction of the equipment and "plumbing", all of which either is glass-lined or constructed entirely of glass, even to pumps handling any of the raw materials. Reason for this is to eliminate any catalytic effect on the operations which ordinary metal materials of construction might possess.

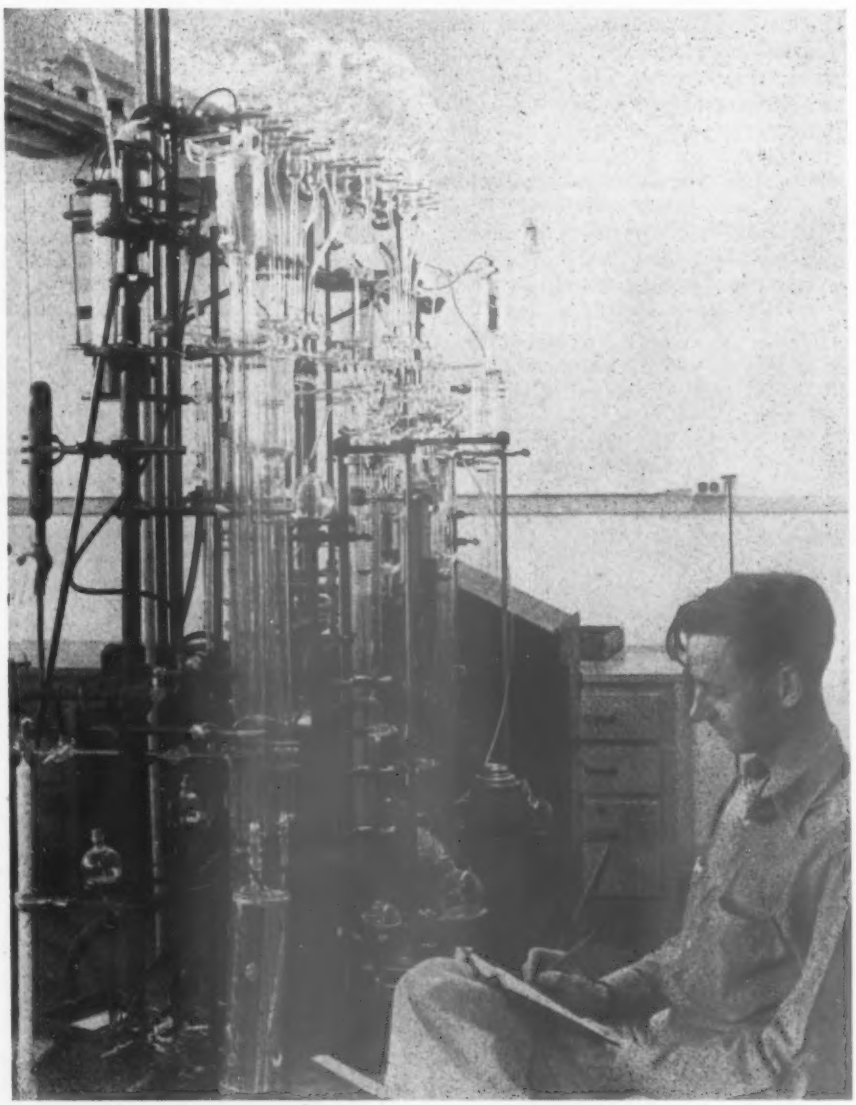
Piping is of glass considered capable of withstanding up to 175 psi pressure. It is suitably protected by steel and wooden guards to avoid accidental breakage from blows. Distillation and stripping columns also are of glass, the joints being cemented together with asbestos packing bonded by one of the new silicone plastics. The stripping column is not packed, the distillation column is filled with ceramic packing.

The function of this plant and its adjacent pilot laboratory will be to work out problems in conjunction with the Phillips-operated butadiene plant, the Goodrich-operated GR-S plant, and Phillips' carbon black plants. Research preceding these operations originates either at the Bartlesville, Okla., laboratories or the newly built one at Phillips. Compounding and milling operations will be carried on at the latter location.

Ethyl Blending Plant

The Ethyl blending plant closely resembles a commercial installation, except for size and ability to meet laboratory accuracies in TEL blending. All of the usual requirements for safety of personnel are followed in its construction and the blending tanks are not housed. Each tank is equipped with one or more electrically-driven agitators, and will handle quantities ranging in volume from a few gallons to tank-car lots. By suitable cross-connections the blending requirements of a small refinery can be met with considerably more accuracy than required. Connections are available to nearby pure hydrocarbon storage, so that unusual experimental fuel combinations, such as those for the "sky lab," can be made at will.

Philblack, a new and reportedly revolutionary type of carbon black, has longsince outgrown its initial pilot plant at Burbank, Okla. A new one has been built at Phillips to fill the need for more space and equipment. This product is said to be highly satisfactory for compounding synthetic rubber. Since the manufacturing process is flexible and will permit the same equipment to produce a number of varieties of this black, pilot operations are of continuing necessity and importance to produce a critically needed war material.



High precision fractional distillation apparatus seen in this picture and used in the analysis of petroleum fractions is one of many to be found in Phillips' new pilot research laboratory. Glass bulbs at top contain the pure fractions separated in this equipment

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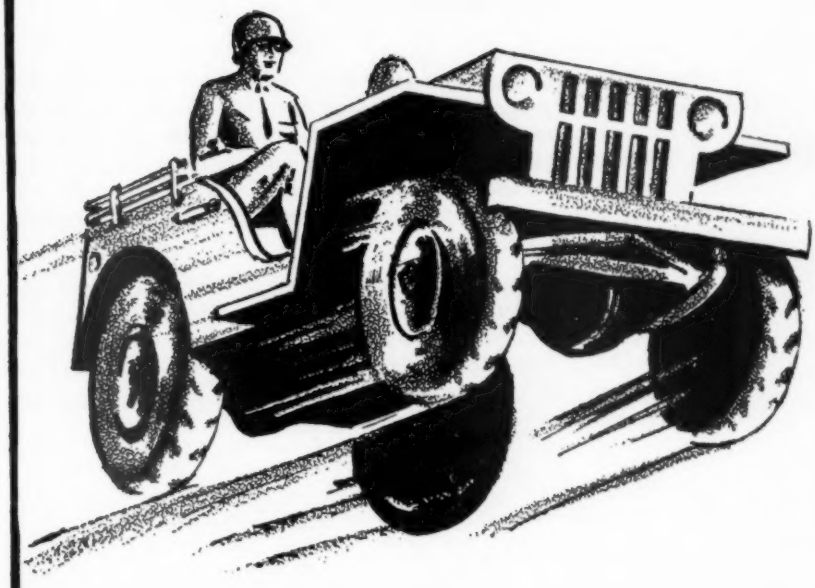
Lead Fluoborate



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The Improved Fluid Process For Catalytic Cracking

By E. V. Murphree, C. L. Brown, E. J. Gohr, C. E. Jahnig, H. Z. Martin and C. W. Tyson

The engineering improvements which have been made in the Fluid catalytic cracking process since it was first introduced are described. An important feature is the use of the downflow principle of circulation of the fluidized catalyst stream, in which only a small amount of solid material passes overhead with the gas. In the older units the upflow principle was followed, in which all the catalyst was taken overhead to the dust recovery equipment.

Recovery of the small proportion of catalyst remaining in the product stream going to the fractionator is by means of scrubbing by a circulating stream of heavy bottom products. Heat balance between the reactor and regenerator is closely controlled and in general the use of extraneous heat is not required. Limited data are given on products produced in the wartime operations of the Fluid catalyst plants.

DURING the past year a large number of Fluid catalytic cracking plants of improved design have been put into commercial operation. These units, now producing large quantities of 100-octane gasoline and synthetic rubber raw materials, include major simplifications over the process as previously disclosed[1, 2]. This paper discusses the engineering features of the new design and includes a description of the plant and the mechanics of its operation.

The Fluid catalytic cracking process which was originated and developed by the Standard Oil Development Co., in essence comprises a new method of contacting gases and solids. In this technique the solid is handled as a fine powder and is suspended in the gas with which it is to be contacted. The solid material is maintained in a fluid or freely flowing condition at all times and thus can be handled in much the same way as a liquid, although in contrast to liquid behaviour the density of this "fluid" can be altered markedly by changing the solids-to-gas ratio or the flowing conditions.

Because of the vital part played by the fluid catalyst process in producing war products, it has been necessary to omit detailed information at many points in this paper.

The Old and New Methods

A comparison of the old and the new methods, which have been termed "upflow" and "downflow" operation, respectively, is shown in Fig. 1. In both cases pressure required for the flow of solid materials from a low pressure source to a zone of higher pressure is attained by means of a standpipe. The fluid mixture enters the top of the standpipe in a fairly dense condition favorable to building up static pressure and as it passes down the standpipe its density tends to increase since the fluid is compressible. To avoid attainment of densities at which bridging and uneven flow would result, it is desirable to add aeration gas along the length of the standpipe.

In the downflow principle illustrated in the left-hand portion of Fig. 1, the finely divided solid material under elevated pressure at the base of the inlet solids standpipe flows through a control valve into an injection zone where it is diluted by a suitable gas stream and blown into the reactor. The velocity in the reactor is greatly decreased so that the solids tend to concentrate in the gas stream.

Under these conditions the solids form a dense, turbulent bed having a relatively clearly defined level. The velocity in the vessel is sufficiently low and enough disengaging space is provided above the level so that only a small amount of solid passes overhead with the gas. The reaction vessel is made large enough to afford the required reaction time in the dense bed of fluidized solids, and the major portion of the solids fed to the reactor is withdrawn through a well to the outlet solids standpipe.

This may be compared with the older and previously disclosed upflow principle illustrated in the right-hand side of Fig. 1, wherein all of the fluidized stream is taken overhead to dust recovery equipment. The advantages of the downflow arrangement are:

1. The problem of dust recovery has been materially reduced since only about 0.5% of circulating solid stream must be recovered.

2. The level of solids and consequently the degree of contact in the reactors can be set at will. In upflow operation the solids holdup is a function of numerous operating variables.

3. The height of the supporting structure is less due to lower standpipe length because of less pressure drop in the fluidized solids circulation stream.

4. External hoppers are not needed since inventory changes are easily manipulated in the reaction vessels themselves.

5. The solids recovery equipment may be incorporated (in part at least) within the reaction vessels.

It is apparent from the above that the downflow system will provide lower investment as well as maintenance costs.

The New Design as Applied To Catalytic Cracking

Catalytic cracking of petroleum is essentially a two-stage operation. In the first step, the oil is contacted with the catalyst whereby the latter becomes fouled with coke. In the second stage, the catalyst must be burned free of this deposit. This is accomplished by the Fluid process as a truly continuous operation in which the fluid catalyst is continuously circulated without mechanical means between the reaction and the regeneration stages.

Fig. 2 shows a flowsheet of the downflow type of fluid cracking unit now in wide use. Catalyst enters the regenerator well and flows down through the regenerated catalyst standpipe through a slide valve into the reactor inlet line. The particle size of the catalyst normally used may vary between 5 and 50% on 100 mesh. The catalyst is mixed with the oil at this point at ratios of 5 to 30 pounds of catalyst per pound of oil, depending on the specific conditions employed. It will be noted that on this basis large quantities of catalyst must be circulated, corresponding to approximately 8 to 50 tons per minute for a 15,000 b/d plant.

From the injector the mixture flows upwards into the reactor where it mingles with the dense bed of fluid catalyst, which can be adjusted to such height as to obtain the degree of cracking desired. This vessel, in large fluid units, may have a diameter of 25 ft. and a height of 50 ft., with a holdup of fluidized, turbulent catalyst amounting to as much as 75 to 100 tons.

The catalyst leaving the fluidized reaction bed passes into the bottom of the vessel, where it is stripped of hydrocarbon vapor with upflowing steam in-

This article was originally presented before the American Institute of Chemical Engineers semi-annual meeting at St. Louis, Nov. 19-21, 1944, and is reprinted from the Transactions of the Institute for February, 1945. *Mr. Murphree is with the Standard Oil Development Co. in New York, Mr. Brown with the Esso Laboratories of the Standard Oil Development Co. of Louisiana at Baton Rouge, and the other authors with the Esso Laboratories of Standard Oil Development Co. at Elizabeth, N. J.*

jected into the bottom of the vessel. From this stripping zone the solid flows into the spent catalyst standpipe, through a slide valve for flow control and into a spent catalyst return line where it is mixed with air for regeneration and blown into the internally insulated regenerator. Here again the catalyst mixes in a dense fluid bed which is of such volume that sufficient time for the regeneration step is obtained. The regeneration vessels in 15,000 b/d commercial Fluid units ordinarily have a catalyst holdup of 150 to 300 tons. From this point the catalyst continues around the circuit again.

As brought out in discussing Fig. 1, high standpipe and low return line densities are maintained to facilitate catalyst circulation. High vessel densities make possible attainment of required reaction and regeneration contact times in reasonably sized equipment. It is of interest that the degree of settling of the finely powdered catalyst in the vessels is much greater than might be expected. For example, the average relative velocity of the catalyst with respect to the gas stream in the fluid existing in these vessels is found to be much greater than the velocity of free fall predicted by Stokes' Law.

The oil to be cracked is pumped from storage through a set of heat exchangers in which it is preheated by a fractionator bottom stream to a temperature which may be varied between 100 and 400° F. The stream of heated liquid feed, which may vary in boiling range from naphtha to heavy crude fractions, is injected into the stream of hot regenerated catalyst leaving the regenerated catalyst slide valve.

The regenerated catalyst is at a temperature of 1000° to 1150° F. and causes very rapid vaporization and heating of the charge stock to cracking temperatures of 800 to 1000° F. The fluid

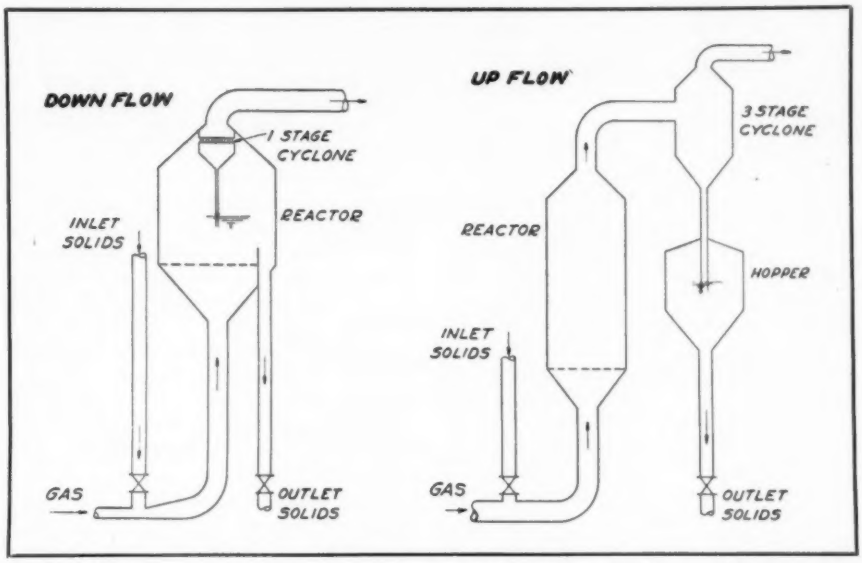

Fig. 1—Left, improved down flow design of the Fluid catalytic cracking process which practically eliminates passing the catalyst overhead with the gas; right, earlier design where all the fluidized stream was taken overhead to dust recovery equipment

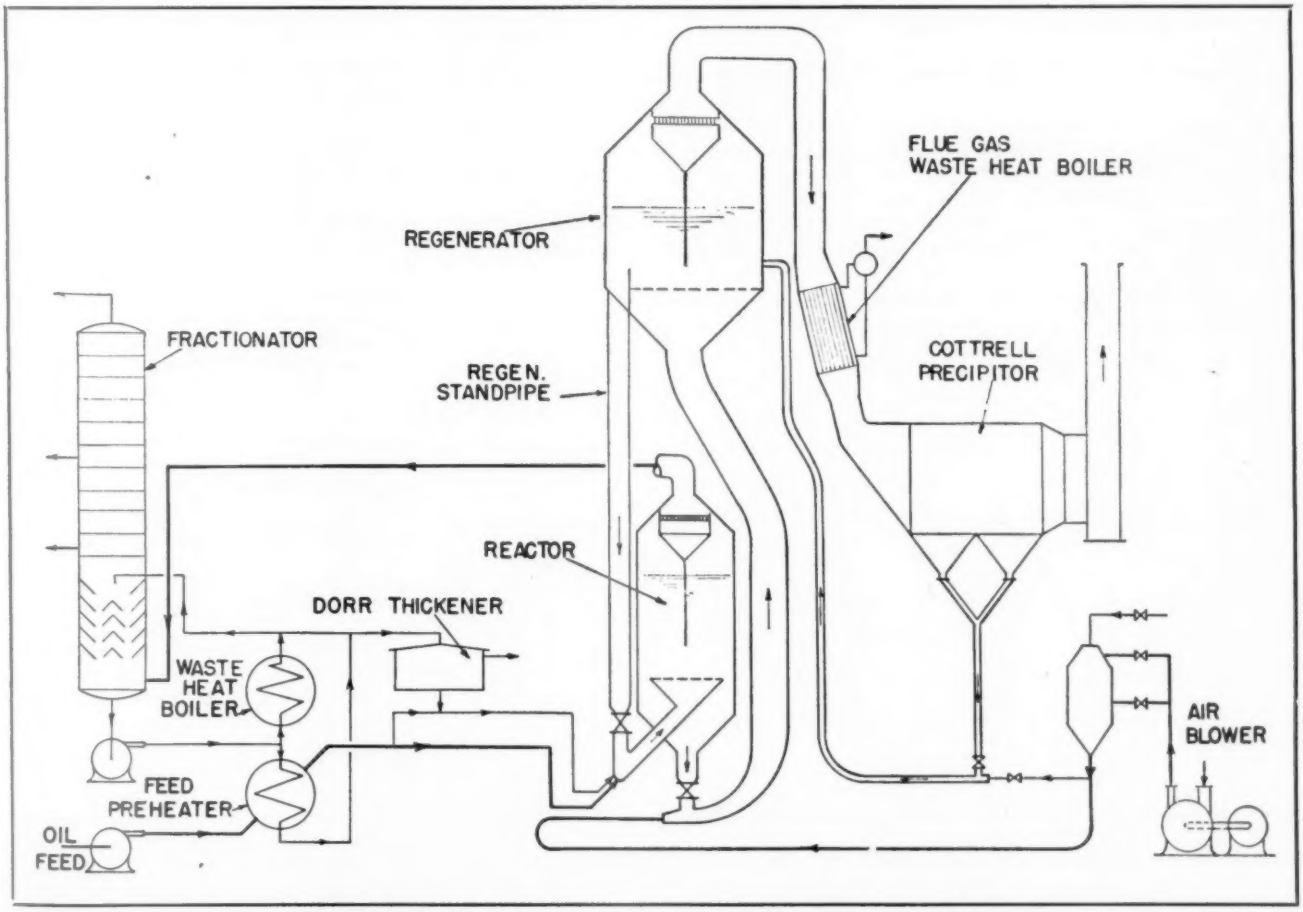

Fig. 2—Flowsheet of the downflow type of Fluid catalytic cracking unit

mixture flows into the reactor, which is ordinarily held at 8 to 12 psig. Considerable flexibility in the severity of treatment is provided by simple regulation of the catalyst level in the reactor, or by change in the rate of catalyst circulation. Temperatures are uniform as a result of the heat capacity and turbulence of the fluidized catalyst mass.

The cracked product vapors leave the dense fluid catalyst bed and pass through a single stage of cyclone separators mounted in the upper head of the reaction vessel. In this equipment, the greater part of the small quantity of entrained catalyst particles is removed from the gas stream and returned through a dip pipe to a point well below the level of catalyst in the dense bed. This method of returning the recovered catalyst to the main circulating stream is simple, and effectively prevents back flow of oil vapors.

The cracked products leave the top of the reactor and pass into the bottom of the fractionator. This tower is of conventional design for the most part and separates the products into a wet gas stream, light distillate, gas oil and cycle stock. The bottom of the tower below the usual bubble trays is fitted with 5 disc and 4 donut trays over which a stream of heavy bottom products is circulated. This stream removes heat from the oil vapors, cooling them to 550 to 600° F., and is then passed through a series of heat exchangers where it gives up heat to the fresh feed, any excess being used to produce high pressure steam.

In passing over the disc and donut section the circulating oil stream also scrubs out the remaining catalyst from the entering product stream and it is the resultant slurry of catalyst in heavy bottom product which is circulated over the discs and donuts and through the heat exchangers. The removal of dust from the vapors is virtually complete since no deposits are found on the bubble trays above the discs and donuts or in the side stream or overhead products.

A small portion of the circulating slurry stream is withdrawn for the recovery of the catalyst it contains. The quantity of this so-called "slurry return" is generally about 3 to 10% of the fresh reactor charge and contains about 0.5 lb. of catalyst per gallon. The catalyst concentration of the slurry is controllable and may be decreased by increasing the rate of slurry return. By maintaining slurry concentration below 0.5 lb. per gallon, erosion of slurry pumps and valves is negligible.

Early practice was to send the slurry return directly to the reactor inlet line which obviously meant cracking a portion of the heaviest oil product to extinction and consequently led to high carbon formation in the reactor. Slurry return is now sent to a Dorr thickener where about 70% of the heavy oil is removed as a clarified oil containing less than 0.01 lb. of catalyst per gallon. The thickened sludge containing most of the catalyst is mixed with fresh feed for dilution and pumped to the reactor inlet for recovery of the catalyst.

Air Flow

The air-flue gas system starts at the turbo-blowers where air for regeneration is compressed to 13-15 psig. The air flows through an auxiliary burner, used for starting up the plant, and then to the spent catalyst return line where it dilutes the solids flowing from the spent catalyst standpipe and enters the regenerator. Here the coke deposit on the spent catalyst is burned at a temperature of 1000-1150° F., the carbon content of the catalyst being reduced to less than 1% and generally to about 0.5%. Pressure in the regenerator is ordinarily maintained at 2 to 4 psig. The resulting flue gases plus a small amount of entrained catalyst leave the dense bed of catalyst and pass through a single stage of cyclone separators where most of the catalyst is recovered and returned to the dense bed through a dip pipe as described in connection with the reactor.

The hot flue gases then leave the regenerator containing a small quantity of catalyst and pass through a waste heat boiler where the gases are cooled to about 600° F. and by-product high pressure steam is produced. For a final cleanup, the flue gases are treated in a Cottrell electrical precipitator, from which they are discharged to the atmosphere with a solid content of about 0.15 grains per cu. ft. The fine catalyst recovered in the precipitator drops into a set of hoppers from which it is returned to the regenerator through a standpipe system.

Catalyst Storage

Two storage hoppers are provided, each large enough to hold the entire plant inventory of catalyst. By imposing air pressure above the catalyst bed in the hoppers and operating them as blowcases, catalyst may be added to the system at super-atmospheric pressure. The catalyst flows from the bottom of the storage hopper into a stream of air from the regeneration air blower and this mixture is introduced into the spent catalyst return line.

Catalyst can be removed from the base of the regenerated catalyst and Cottrell standpipes and conveyed in a stream of air to the storage hoppers. In order to avoid the necessity of designing the storage hoppers to withstand high temperature conditions existing in the regenerator, the air-catalyst mixture can be passed through a cooling coil where its temperature is lowered to 150 to 250° F. before it reaches the storage hoppers. Another and perhaps more satisfactory technique when shutting down a plant is to cool the catalyst in the regenerator before removal, by blowing with air after the carbon has been burned off completely.

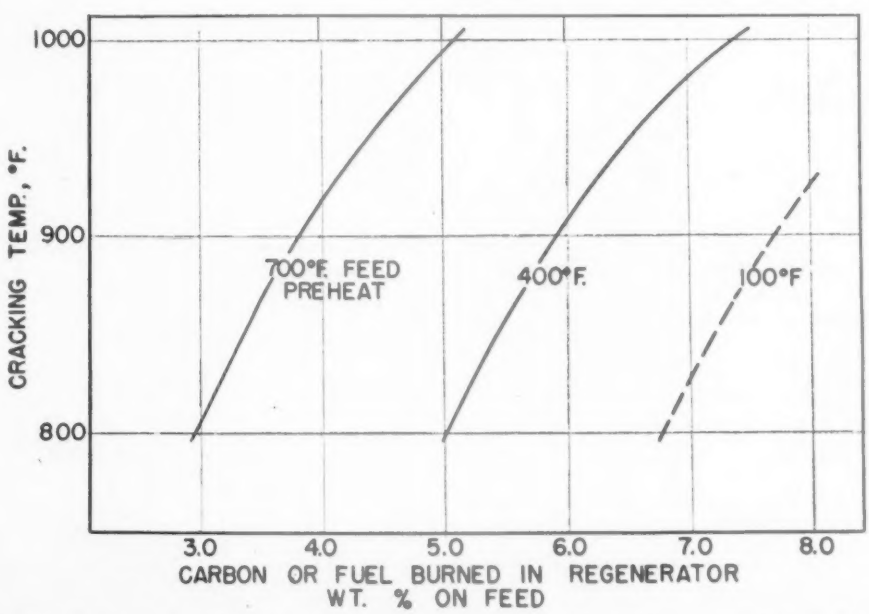

Fig. 3—Overall heat balance around reactor and regenerator in a Fluid cracking plant

Heat Balance

In addition to the ability to transfer large quantities of solids from one zone to another the fluid technique is of particular interest for its ability to transfer coincidentally large quantities of heat. In many Fluid catalyst cracking units a transfer of over 150 MM btu hr. from the regenerator to the reactor is regularly carried out. By this means the heat of regeneration is dissipated and at the same time used to supply the heat required for preheating, vaporizing, and cracking the oil. This is accomplished by direct con-

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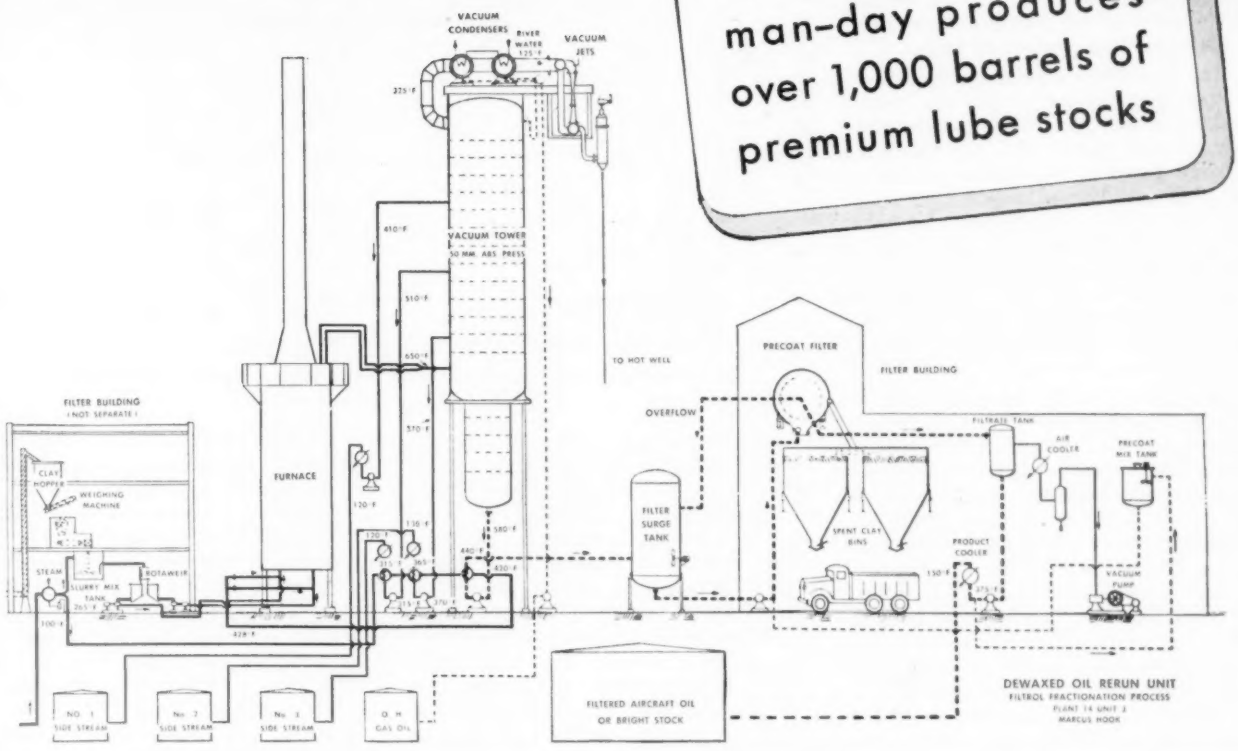

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tact of oil with hot regenerated catalyst, which provides a very satisfactory means for heating hydrocarbons and eliminates expensive heat exchange surface. Thus, feed stocks which are difficult or impossible to vaporize in conventional tubular equipment may be charged directly to a Fluid cracking reactor without interruption for long periods of time.

The principal variables involved in an overall heat balance around the reactor and regenerator of a Fluid cracking plant are shown in Fig. 3. This plot shows the relation between the amount of carbon or other fuel burned in the regenerator and the reactor temperature obtainable at several feed preheat temperatures. If the rate of carbon production from the cracking step is less than that indicated as necessary by the curves, the deficiency may be made up by adding oil fuel to the regeneration system.

In general practice the use of extraneous fuel is not required for heat balance since more war products can be made by using the entire regeneration system capacity for burning catalytic carbon. In those plants not equipped with furnaces for preheat, feed temperatures between 100 and 400° F. may be obtained and any combination of cracking temperature and carbon burning rate lying in the area between the 100 and 400° F. lines is possible in so far as overall heat balance is concerned. For example, 900° F. cracking temperature may be maintained with carbon burning rates varying between 5.9 and 7.7% on feed.

In all probability, peace-time operation will demand a less severe degree of gas oil conversion and the percent of catalytic carbon on feed will be lower than

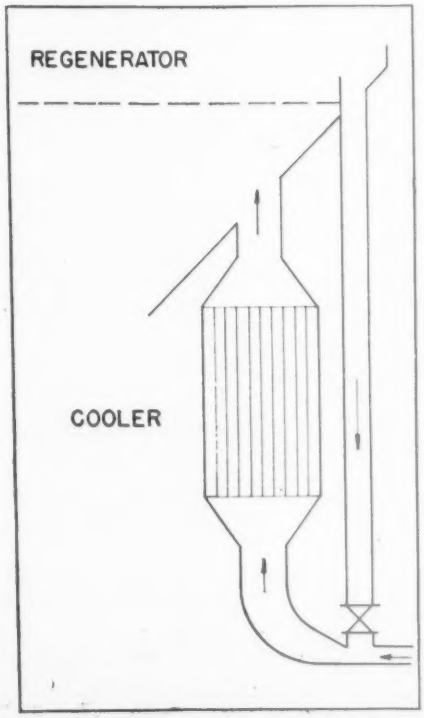

Fig. 5—Regenerated catalyst cooler

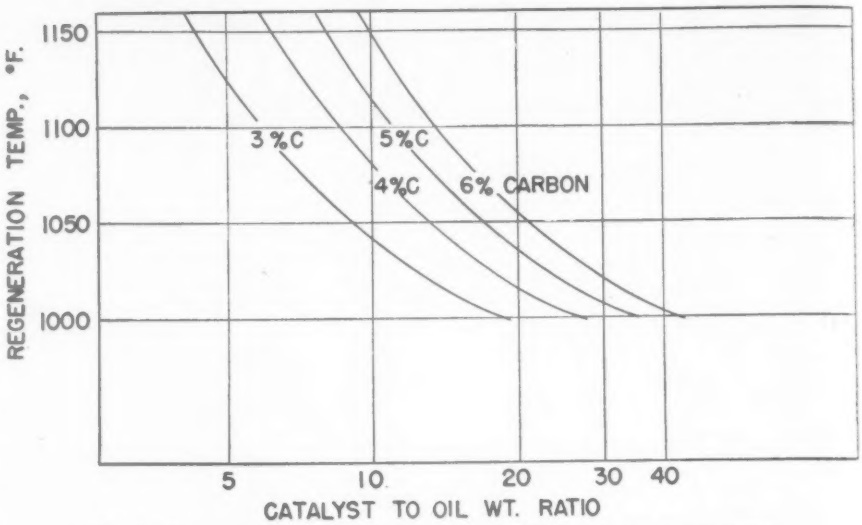

Fig. 4—Regenerator heat balance for a 950° F. reactor temperature

is present practice. The deficiency in carbon production may be supplied either by the use of extraneous fuel in the regenerator or by supplying the extra heat as additional preheat in the feed. Since there are limitations in the regeneration system such as air blower capacity, etc., greater plant processing capacity may be obtained by the addition of a preheat furnace. If, for example, a furnace is sufficient for maintaining a 700° F. oil preheat temperature, the flexibility as regards overall heat balance will include the entire area between the 100 and 700° F. lines.

Since the heat produced in the regenerator is consumed in the reactor, a heat balance drawn about either of these elements will serve to indicate the magnitude of heat and mass transfer required to satisfy the conditions assumed. In Fig. 4 the relation between catalyst circulation rate expressed as catalyst to oil weight ratio and regenerator temperature is shown for the case of 950° F. reactor temperature. A family of lines representing carbon burning rates of 3, 4, 5 and 6% on feed is presented. These lines indicate that catalyst circulation rates may be increased sharply as the regenerator temperature approaches the reactor temperature. This fact is the basis for the great flexibility in catalyst circulation rate in Fluid cracking units. Thus, the line for the 5% carbon burning rate covers a range of catalyst to oil ratio from 8 to 35, or over fourfold when the regenerator temperature is varied from 1150 to 1000° F. This variation is possible without altering other primary processing conditions.

It has been pointed out above that additional heat to satisfy heat balance may be added in the form of extraneous fuel. Conversely, excess heat may be removed by incorporating a regenerated catalyst cooler as is shown in the design of Fig. 5. By this means a part of the heat of regeneration is transferred to boiling water and catalyst circulation may be reduced correspondingly. Thus, catalyst to oil ratios may be reduced to any desired value below those shown in Fig. 4. However, a corresponding amount of furnace capacity may have to be added to satisfy the overall heat balance conditions set forth in Fig. 3.

The extreme flexibility in catalyst to oil ratio, in addition to the possible variations in reactor holdup already mentioned affords a large change in the severity of cracking. Since the degree of conversion may be increased by increasing catalyst to oil ratio or reactor holdup, coincident use of both of these variables may be made in order to attain the best suited cracking conditions for any particular type of operation on stocks of widely differing characteristics.

Specific Design Features

Instrumentation

The instrumentation in a Fluid plant is unique in that it involves the measurement and control of pressures, flows, and levels in lines and vessels containing dust.

Fig. 6 shows the piping required for a pressure tap for actuation of such instrumentation. It consists of a connection to the point of measurement into which a small quantity of gas is bled continuously to prevent plugging with catalyst and a line to the pressure gauge or other instrument. A line for cleaning out the tap by a blast of high pressure gas is also indicated.

Catalyst holdup is measured by two such taps installed at the top and bottom of the vessel. From the pressure differential thus measured the weight of catalyst between taps can be calculated. To measure the density in the bed, two or more taps must be located in the dense bed and by such an arrangement the catalyst level can be located.

Catalyst flow rate can be measured by heat balance around one of the vessels or by a carbon balance, the latter method

involving calculation of the rate of carbon burning from the air quantity and flue gas analysis in addition to a carbon analysis of both spent and regenerated catalyst. For instantaneous indication of flow rate, the catalyst and gas stream can be passed through an orifice or venturi meter, the readings on which are a function of the catalyst concentration of the gas stream. For moderate pressure drops the simplified venturi meter equation has been found to apply to cases where gas-powder mixtures are being metered if the fluid density used is that of the flowing stream.

Another more qualitative method has been devised wherein the air rate to the spent catalyst injector and the pressure differential across a measured vertical length of the spent catalyst return line are used. This pressure gradient has been found to depend on the catalyst circulation rate, other factors remaining unchanged, and the device is a very useful indicator of catalyst flow changes.

Slide Valves

Fig. 7 is a sketch of the slide valve used for control of catalyst flow. These valves are simple and rugged and have been found to give little trouble. The plant has a common circulating oil system for motivating these valves through piston operators. The valve is designed to have a large open space underneath so that catalyst accumulations cannot build up and prevent movement of the slide. In 2½ years of operation no case of plugging or binding of the valves is known to have occurred.

Catalyst Recovery

Some of the plants are equipped with "multiclone" type cyclones licensed by the Western Precipitation Corp. These consist of an assembly of small cyclones operating in parallel and mounted in the upper heads of the reactor and regenerator. The collected dust falls into a common hopper located below the multiclones and is returned to the dense catalyst bed through the dip pipes, as already discussed. Cyclones manufactured by the Buell Engineering Co. are also in use.

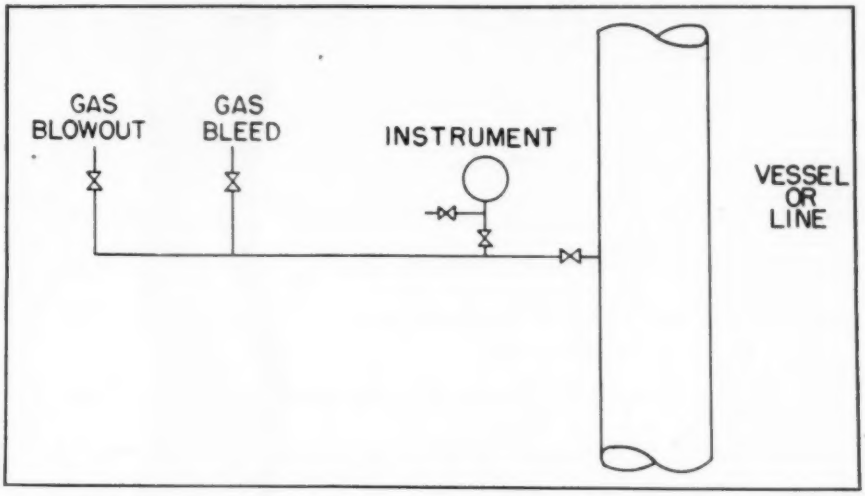

Fig. 6—Pressure connection for actuation of instrumentation in a Fluid cracking plant

TABLE 1

Yields and Qualities of Aviation Components Once-Through Cracking with Synthetic Catalyst —Commercial Downflow Fluid Plants

Feed Stock	Paraffinic	Naphthenic
Gravity, °API	32.0	30.7
ASTM, 50% @ °F.	618	539
Diesel Index	57.0	46.3
Sulfur, Wt. %	0.34	0.16
Aviation Components		
Base Stock (7 lbs. RVP), Vol. %	25.8	31.8
Excess C_5, Vol. %	6.6	0.0
Total C_5, Vol. %	11.8	8.9
Total C_4, Vol. %	17.5	15.9
Butylenes, Vol. %	8.7	6.8
Isobutane, Vol. %	7.0	7.2
Cracked Gas Oil, Vol. %	33.5	35.1
Quality of Untreated Base		
Reid Vapor Press., psi	7.0	7.0
ASTM, % @ 293 °F.	90.0	75.5
Bromine No., cg./G	65	47

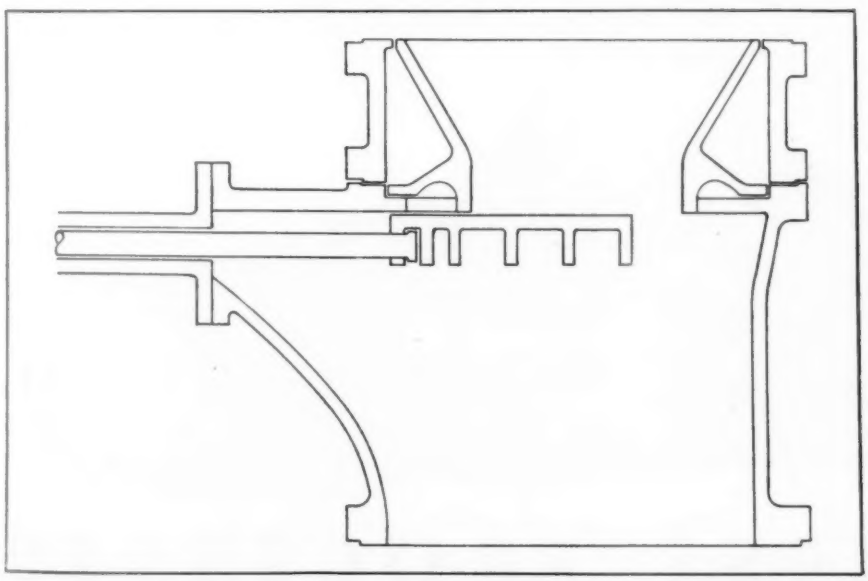

Fig. 7—Slide valve used for control of catalyst flow in Fluid cracking unit

The Cottrell precipitator is arranged for horizontal flow of the gases and the collected dust falls into hoppers below the Cottrell proper. The Cottrell should be operated at 400° F. or lower for best results, compared with the optimum flue gas outlet temperature from the waste gas coolers of 600° F. A system of superheated water spray injectors in the Cottrell inlet line is employed to get down to the desired temperature and at the same time avoid wet catalyst accumulation. Water vapor in the gases to the precipitators is maintained at 20 to 25% by volume to help prevent arcing.

During the early operation of the 15,000 b/d units it was learned that the addition of 6 to 10 pounds per hour of ammonia vapors or about 0.005% by weight of the flue gas caused an additional marked increase in efficiency. This striking result is believed to be due to an increase in electrical conductivity of the solid material, permitting release of its charge to the collection plate more readily.

Plant Performance

There are in operation in the U. S. 36 Fluid cracking units having a total nominal throughput of about 400,000 b/d. Of these, all but 4 are of the new downflow design. All of these plants are operating to produce aviation base stock and olefins for production of aviation blending agents or butadiene. Many of these units are operating at feed rates in excess of design. Runs in excess of 6 months' duration have been made and present scheduled operating periods for units operated by the Standard Oil Co. of New Jersey are set up on the basis of

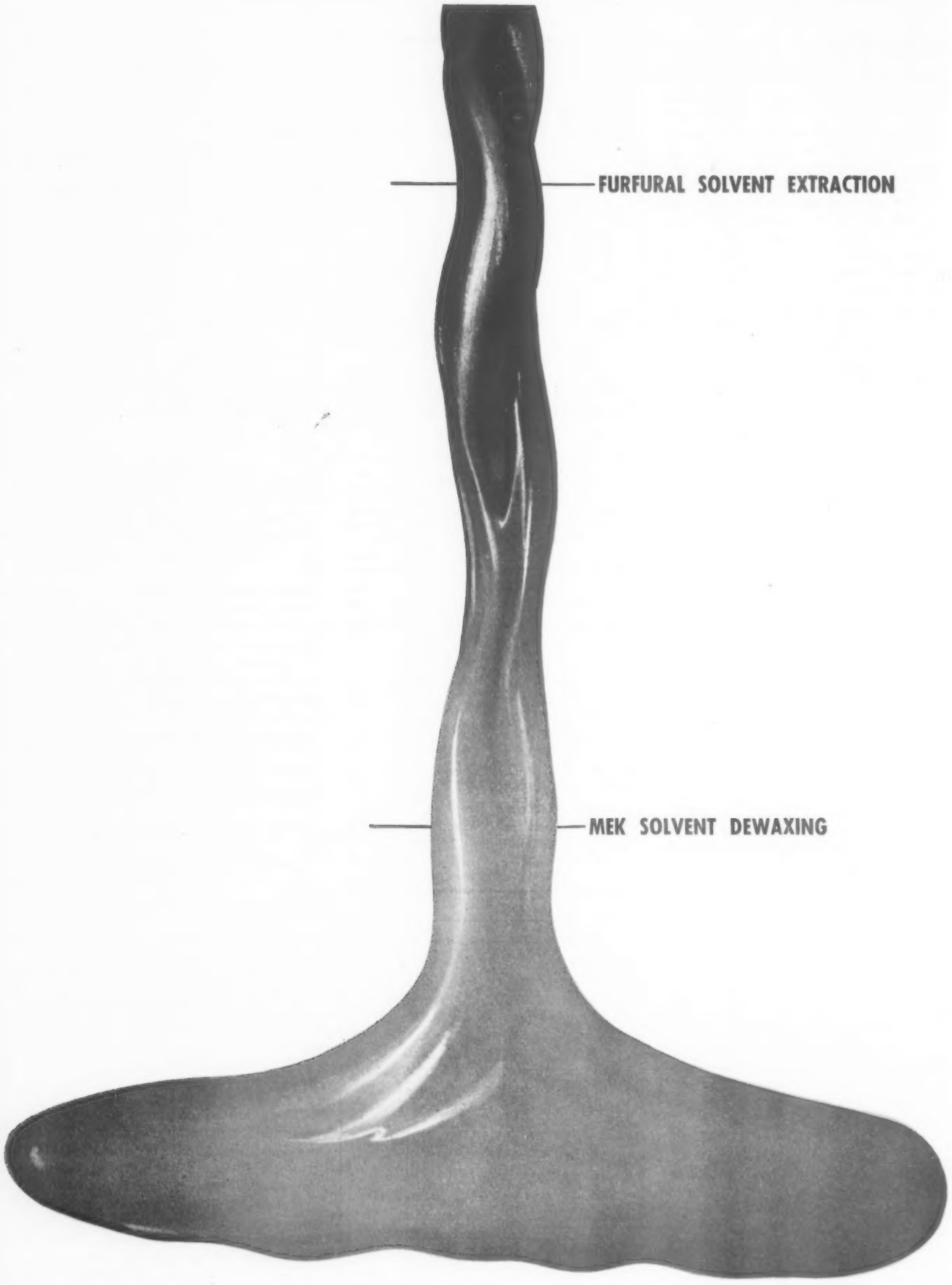

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TABLE 2—Acid Treatment of Fluid Catalyst Aviation Base Fractions for Anti-Knock Quality Improvement

Catalytic Aviation Base Fraction	Paraffinic Gas Oil Feed				Calculated Blend
	Light Naphtha		Heavy Naphtha		
Typical Data	Raw	Treated*	Raw	Treated†	Treated‡
Gravity, °API	65.9	66.4	36.9	36.4	44.3
RVP, psi	5.0	5.0	2.0	2.0	3.0
Bromine No., cg/G	87.5	55.1	17.3	3.6	...
Sulfur, Wt. %	0.030	0.020	0.054	0.025	0.024
ASTM Distillation					
I.B.P., °F.	125	125	220	228	...
10% at °F.	142	146	257	263	185
50% at °F.	158	160	288	289	270
90% at °F.	197	193	325	325	318
F.B.P., °F.	236	221	350	348	...

*Treated with 15 lbs. of 93% H_2SO_4 per barrel raw naphtha.
†Treated with 23 lbs. of 90% H_2SO_4 per barrel raw naphtha.
‡Using production proportions.

8 months between shutdown periods, indicating that good service factors are obtainable.

Erosion in the downflow plants, in general, has been quite minor. Virtually no erosion has been experienced in lines since velocities have been adjusted with this in mind. In some cases erosion has been noticeable in the cyclone vanes and in the collection tubes adjacent to the vanes. This wear, however, has not been sufficiently serious to affect the operation of the units. A small amount of wear has been found on the gates of the slide valves, which of course are readily replaced during turnaround periods. The minor character of the erosion experience is borne out by the long running periods obtained on the downflow units.

Catalyst recovery is an important item in the operation of the Fluid catalyst units since this material is relatively costly. After initial operating conditions were adjusted, very satisfactory catalyst recoveries were obtained on the downflow fluid units. The major catalyst loss is obtained in the flue gases leaving the Cottrell precipitator, the remainder representing the small amount of catalyst in the clarified oil leaving the slurry oil settler.

The following table shows actual catalyst losses obtained in several 15,000 b/d plants operated by affiliates of the Standard Oil Co. (N.J.). The figures cover the total measured inventory loss for complete runs, including starting up and shutting down periods.

	Length of Run, Days	Av. Tons Per Day Loss
Standard Oil Co. of La.		
No. 2 Unit	181	3.3
No. 3 Unit	180	1.9
Lago Oil & Transport Co., Ltd.	183	3.6

The above figures and other information on current operations indicate a loss of 2 to 3 tons per day on the 15,000 b/d downflow plants. This loss may be appreciably reduced through modification in design.

Process Data

Maximum production of materials of war has been the prime objective in the operation of all Fluid catalyst plants. Cracking has accordingly been carried out for the most part at high temperatures with a synthetic type catalyst, charging gas oils once through at fairly severe levels of conversion. Thus, of the 5 plants of the improved type currently operated by the Affiliates of the Standard Oil Co. (N. J.), only the first was operated with a natural type catalyst at the relatively mild conditions which are more representative of normal operations for the production of motor gasoline. This operation established in a short period the satisfactory performance of the new design, and little process data on this type operation are therefore available.

Current specification 100-octane aviation fuels are composed primarily of isopentane, base stocks and alkylate, of which the latter is the most vital component due to its high antiknock quality. Consequently, in integrated refinery operations for maximum production of 100-octane aviation fuel, the most efficient utilization of Fluid catalyst units normally involves cracking for maximum production of butanes, butylenes and amylenes to be used as alkylation feed stocks, with secondary emphasis on quality of raw aviation base stock, which can be readily improved by further refining in equipment other than catalytic.

Typical yields and qualities of aviation components produced from Fluid units operating in this manner are presented in Table 1. Owing to wartime restrictions, it has been necessary to omit disclosure of the octane numbers of the aviation gasolines produced. Illustrative of refinery methods employed to improve raw base stock quality are results in Table 2 obtained by simple acid treating raw stocks with spent sulfuric acid from alkylation plants.

Information on quality of motor gasoline fractions produced in commercial operations of the downflow Fluid catalyst plants is quite limited at the present time. Motor gasolines produced in the commercial upflow units from paraffinic gas oils, however, have ranged in quality from 91-98 CFR-R octane number clear, and from 98-10? with 3 cc. TEL/vol. added. The anti-knock quality of the product is influenced largely by cracking temperature and type of catalyst, as illustrated in Fig. 8. Of significant im-

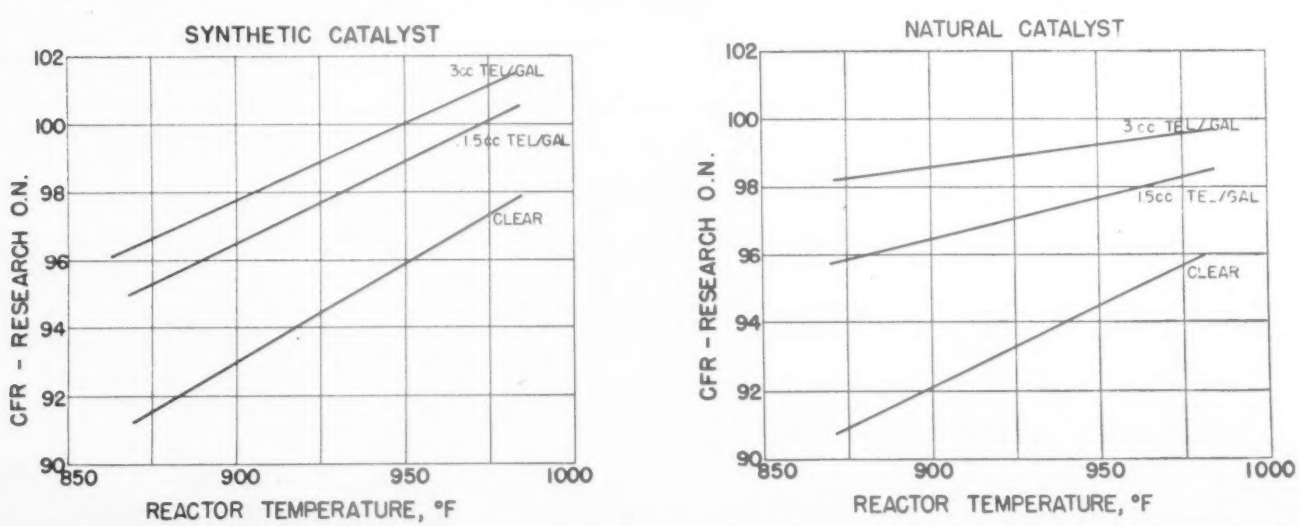

Fig. 8—Anti-knock quality of Fluid Catalyst motor gasolines from paraffinic gas oil feed stocks (Basis: 10 RVP, 400 F. end-point motor gasoline). Left, when synthetic catalyst was used; right, when natural catalyst was used

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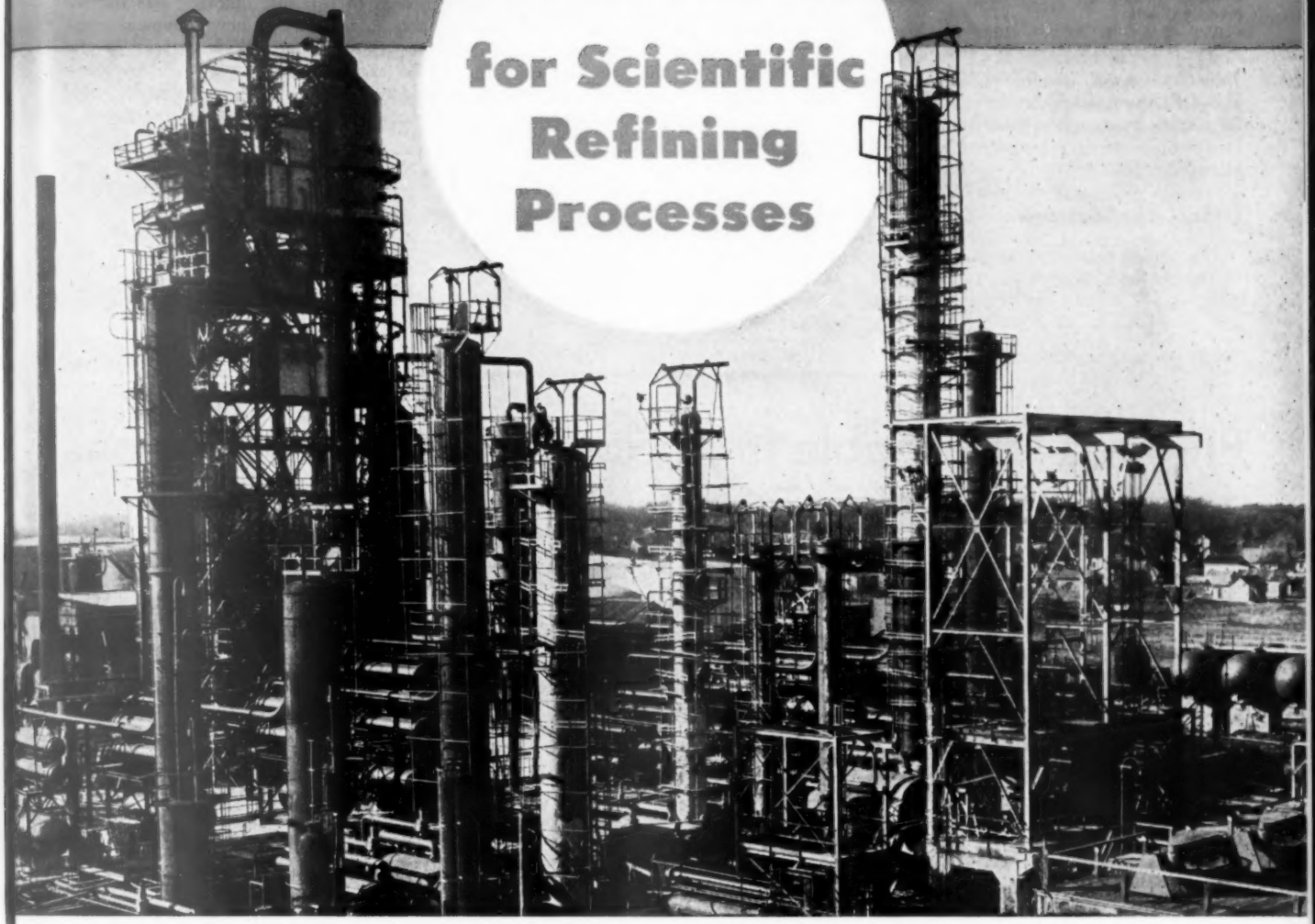

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  - (Girbotol Process)
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  - Reforming
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portance, also, is the type of feed stock cracked:

Type Feed	Paraffinic	Naphthenic
Feed Stock		
Gravity - °API	31.0	25.0
ASTM: 50% @ °F.	650	535
Cracking Temp., °F.	965	965
Product Quality		
RVP - #/Sq. In.	10.0	10.0
Octane No. CFR-R Clear	96.8	99.8

Unleaded motor gasoline of essentially 100 CFR-R octane number quality can be readily produced in commercial operations from current design fluid catalyst plants.

Other Applications

The fluid catalytic cracking process represents the first application of the fluid technique to a commercial process. This new tool should find wide application in many other industrial catalytic operations which may or may not involve catalyst reactivation.

In addition, fluid technique should be of use in the broad field involving the addition or removal of substantial quantities of heat. Such operations need not be confined to catalytic processes, since inert or reacting solids may be circulated. The ability of the fluid process to maintain uniform temperatures throughout a reaction vessel is highly advantageous for reactions of an exothermic or endothermic character.

Other processes in which difficulties are encountered in heating or vaporizing materials in conventional equipment may be able to utilize fluid technique. Operations such as ore reduction, coking of coal, water gas manufacture and other specialized chemical processes may represent interesting applications of the process. Concurrent or countercurrent modifications of fluid technique are possible either by stagewise operation or suitable baffling of the reaction vessels.

Commercial application of the fluid process to catalytic cracking has thrown open to industry a new chemical engineering technique. Wide interest in the fluid cracking process has already been evident and application to many new processes and industries is visualized.

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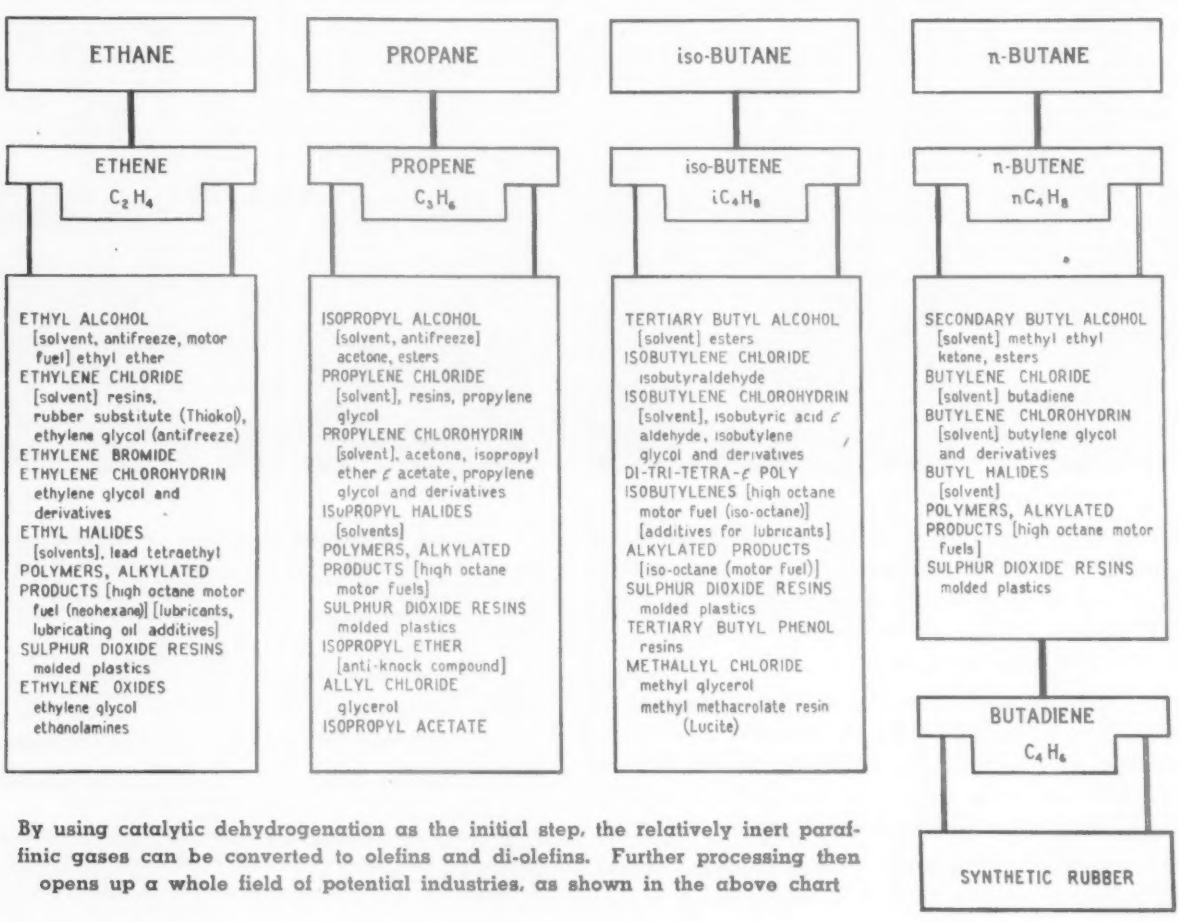
3. Thomas, Anderson, Becker, and McAfee, *A.P.I. Proceedings*, Vol. 24, Section 3, 75-82 (1943).

Products Obtainable from Natural Gas Hydrocarbons


ETHANE
PROPANE
iso-BUTANE
n-BUTANE
ETHENE
C_2H_4
PROPENE
C_3H_6
iso-BUTENE
iC_4H_8
n-BUTENE
nC_4H_8
ETHYL ALCOHOL [solvent, antifreeze, motor fuel] ethyl ether
ETHYLENE CHLORIDE [solvent] resins, rubber substitute (Thiokol), ethylene glycol (antifreeze)
ETHYLENE BROMIDE
ETHYLENE CHLOROHYDRIN ethylene glycol and derivatives
ETHYL HALIDES [solvents], lead tetraethyl
POLYMERS, ALKYLATED PRODUCTS [high octane motor fuel (neohexane)] [lubricants, lubricating oil additives]
SULPHUR DIOXIDE RESINS molded plastics
ETHYLENE OXIDES ethylene glycol ethanolamines
ISOPROPYL ALCOHOL [solvent, antifreeze] acetone, esters
PROPYLENE CHLORIDE [solvent], resins, propylene glycol
PROPYLENE CHLOROHYDRIN [solvent], acetone, isopropyl ether & acetate, propylene glycol and derivatives
ISOPROPYL HALIDES [solvents]
POLYMERS, ALKYLATED PRODUCTS [high octane motor fuels]
SULPHUR DIOXIDE RESINS molded plastics
ISOPROPYL ETHER [anti-knock compound]
ALLYL CHLORIDE glycerol
ISOPROPYL ACETATE
TERTIARY BUTYL ALCOHOL [solvent] esters
ISOBUTYLENE CHLORIDE isobutyraldehyde
ISOBUTYLENE CHLOROHYDRIN [solvent], isobutyric acid & aldehyde, isobutylene glycol and derivatives
DI-TRI-TETRA-& POLY ISOBUTYLENES [high octane motor fuel (iso-octane)] [additives for lubricants]
ALKYLATED PRODUCTS [iso-octane (motor fuel)]
SULPHUR DIOXIDE RESINS molded plastics
TERTIARY BUTYL PHENOL resins
METHALLYL CHLORIDE methyl glycerol methyl methacrolate resin (Lucite)
SECONDARY BUTYL ALCOHOL [solvent] methyl ethyl ketone, esters
BUTYLENE CHLORIDE [solvent] butadiene
BUTYLENE CHLOROHYDRIN [solvent] butylene glycol and derivatives
BUTYL HALIDES [solvent]
POLYMERS, ALKYLATED PRODUCTS [high octane motor fuels]
SULPHUR DIOXIDE RESINS molded plastics
BUTADIENE
C_4H_6
SYNTHETIC RUBBER

By using catalytic dehydrogenation as the initial step, the relatively inert paraffinic gases can be converted to olefins and di-olefins. Further processing then opens up a whole field of potential industries, as shown in the above chart

USE of natural gas as a chemical raw material began in about 1918, when alcohols were found in the diluted acid oil obtained by the sulfuric acid treatment of cracked petroleum distillates. Development of the utilization of natural gas for chemical synthesis was slow, however, partly because erroneous ideas existed regarding the nonreactivity of its hydrocarbon constituents.

Data accumulated by petroleum chemists, particularly in recent years, has disproved this early misconception. We now know that these hydrocarbons will react to produce useful products when activated by the effects of heat, pressure, chemical reagents and light, particularly if catalysts are used.

As these results became known, the possibility of a synthetic organic chemical industry using natural gas as a basic raw material has become apparent. Today this industry is large and growing rapidly in importance.

* * *

(Editor's note—This chart was originally prepared for presentation with the article "Butane Dehydrogenation by the Houdry Process", by R. C. Lassiat and F. D. Parker, which appeared in the Technical Section of NPN, Dec. 6, 1944, pp. R-842-847. The information contained in it was obtained from the Bureau of Mines Information Circular 7108, "Utilization of Natural Gas for Chemical Products", by Harold M. Smith.)

Costs of Oil from Coal and Shale

Of the Best Known Present Processes for Petroleum Substitutes, the Recovery of Oil from Shale Is Considered as Being the Most Practicable for Use in the United States

By Harold S. Bell

Three methods for the production of oil as a substitute for petroleum are compared from an economic standpoint; Bergius coal hydrogenation, Fischer-Tropsch gas synthesis (from coal) and recovery of oil from shale. Capital and operating costs are given in each case for installations for maximum gasoline yield.

It is concluded that none of the three methods can compete with petroleum in normal world markets, except possibly extraction of oil from rich shale. Adaptation of the Fischer-Tropsch method to natural gas will probably precede commercial hydrogenation of coal in this country.

CONSIDERABLE attention has been drawn to our dwindling supplies of petroleum with consequent speculation as to future supplies of motor fuels. Three general approaches have been discussed, often without a sufficiently broad understanding of the processes and their application. The three methods are:

Hydrogenation of coal,
Synthesis of gases,
Extraction of oil from shale.

Petroleum products from the hydrogenation of coal are extensively produced in Germany. Based on the last figures available, the probable present production of petroleum products in that country is in the neighborhood of 5,000,000 metric tons or 35,000,000 barrels annually. Great Britain produces some 1,300,000 barrels from the same source and other countries lesser amounts.

From gas synthesis (and gas synthesis may be conducted upon gases generated from coal), Germany is producing another 2,000,000 to 2,500,000 metric tons or 14,000,000 to 17,500,000 barrels annually. Together with products from direct coal hydrogenation, the volume is sufficient for about one-half of Germany's oil economy.

Oil from shale is successfully extracted in several countries, notably Estonia, Scotland, and Australia.

The U. S. has untold reserves of coal and considerable reserves of oil shale compared to those for petroleum and natural gas. (See Table 1.)

Table 1 reveals that the shale reserves might take care of our needs at present rate of production for 66 years. Coal used for both gas and oil production in addition to our coal needs would last 2300 years, calculating from equivalent B.t.u. values.

Since oil both from shale and by synthesis from coal will be available for years, any present decision will rest upon the economics of the three methods of approach since all three are technically sound.

A brief description of the three methods follows:

The Bergius process is in general use for hydrogenation of coal. The run of mine coal is crushed and mixed with heavy oil that is withdrawn from the process. The coal and oil mixture is introduced into a converter operating at high temperatures and pressures, where it comes in contact with hydrogen in the presence of a catalyst. The mixed oils issuing from the converter are fractionated into gasoline, tar, acids and bases, and heavy oils. The end products are motor fuels, chemicals, Diesel, and fuel oils.

The costs must include mining and crushing the coal to a fine degree, overhead on plant investment, cost of hydrogen, and general operating expenses.

The generally used process for gas synthesis is that of Fischer-Tropsch. In this system, gas from a conventional water-gas set (specifications approximately 30% CO, 60% H_2, 5% CO_2; balance, impurities and a trace of methane) is passed to a converter where at moderate temperatures and pressures and in the presence of a catalyst the carbon of the CO is united with the hydrogen; a side reaction is combination of oxygen with hydrogen to form water. The reaction is controllable within limits as to the size of hydrocarbon molecule formed, and records show that some runs produced a paraffin wax. Normally, a synthetic crude oil is produced, which is distilled, cracked, and otherwise treated in the same way as a crude petroleum oil.

The costs involved include the manufacture of water gas (including the production of coke for the water gas set) and air and steam for operation of the gas generator, catalysis, and subsequent refining, with all overhead and operating costs.

Oil is produced from shale by the choice of several proven methods of retorting. The run-of-mine shale is crushed to about 3-in. size and retorted. The overhead products consist of some fixed gas which is treated for recovery of usable hydrocarbons and a crude shale oil. The crude shale oil is then refined by distillation, cracking, and treating in much the same way as a crude petroleum.

The costs include mining and crushing the shale, retorting and refining, with all of the overhead and operating costs pertinent thereto.

The yields from coal hydrogenation and oil shales are dependent upon the nature of the raw material. Yields from gas synthesis are subject to control. Typical yields reported are as follows:

Bergius direct coal hydrogenation: About 3.65 tons (2240 lb./ton) of coal on a dry, free-of-ash basis per 360 U. S. gal. of gasoline, with some yield of coal-tar chemicals and Diesel and fuel oils. This is approximately 100 gal. of gasoline per long ton of coal.

Fischer-Tropsch gas synthesis: About 15 to 16% by weight of primary product based upon the weight of the coke consumed in gas generation. This is equivalent to about 36 gal. of synthetic crude per ton of coke.

Oil from shale: The yield is directly proportional to the quality of the shale. American shales assay 30 to 60 U. S. gal. to the ton with a weighted average of about 43. Retorting efficiencies, as measured by ratio of recovered oil to assay value, vary from 75 to 90%.

To be economical, the Bergius and Fischer-Tropsch processes must be operated on a large scale. The first-named may be placed at an economic lower limit of about 50,000,000 U. S. gal. of gasoline production per year. At maximum yield some 500,000 long tons of coal are required.

The Fischer-Tropsch process may be stated to have an economic lower production limit of about 10,000,000 U. S. gal. of synthetic crude per year. This requires some 280,000 tons of coke as raw material.

The low economic production limit for oil from shale depends upon the assay value of the shale. For shales of average value, 40 to 60 gal. per ton, prob-

TABLE 1—U. S. Reserves of Coal and Oil Shale Compared with Petroleum and Natural Gas

	Reserves, Billions of Units	1942 Production, Billions of Units	Years' Supply
Coal,* tons	3,181	0.640	4900
Oil from shale,† bbls.	92	None	....
Petroleum,‡ bbls.	20	1.385	14
Natural Gas,§ cu. ft.	97,144	3.100	31

**Energy Sources and National Policy*, 1939 Report of the National Resources Committee.

†Report II of Federal Oil Conservation Board to the President, 1928.

‡A.P.I. Committee on Proved Reserves, Dec. 31, 1942.

§P.A.W., 1943—Preliminary Estimate, Proved Reserves.

The above article is an advance publication of Chap. XXXVI, "The Problem of the Future", from the revised edition of American Petroleum Refining, by Harold S. Bell. The first and only previous edition of this book was published in 1923 and was one of the first books on the petroleum refining industry in the U. S. The author, who is a consulting refinery engineer in New York, has spent several of the intervening years in foreign countries as a consultant on the oil industry for governmental and other agencies. He has studied particularly sources for oil to meet inadequate petroleum reserves.

ably 40,000,000 gal. of shale crude is the lower limit. With richer shales, smaller plants would be economical.

The capital cost of a complete Bergius installation for maximum gasoline production, including equipment for the manufacture of hydrogen, was placed at £12,000,000 in 1936 for an annual production of 45 million imperial gallons. (54 million U. S. gal.). This is equivalent to £0, 5s 4d per imperial gallon of annual production or approximately $0.90 per U. S. gallon.

The Fischer-Tropsch process is more expensive, because of the need for gas generator equipment and a complete subsequent refining and cracking installation. Figures concurrent with the above were given as £0, 7s 1d per imperial gallon of primary oil produced per year, the equivalent of $1.18 per U. S. gallon.

A recent estimate for all mining, retorting, and refining equipment for a rich foreign shale of 90 U. S. gal. per long ton average yield disclosed a capital cost of $18,000,000. Allowing for extra mining and retorting investment to bring the figures comparable to United States average assay values the cost may be placed at not to exceed $21,000,000. When operated for maximum gasoline yield the project would have produced 54 million U. S. gal. This is equivalent to $0.39 per gallon of annual capacity.

Operating costs of the Bergius direct coal-hydrogenation system, including mining, are from $0.17 to $0.22 per U. S. gallon, depending on conditions. Few data are available on Fischer-Tropsch operating costs but they are believed to be comparable.

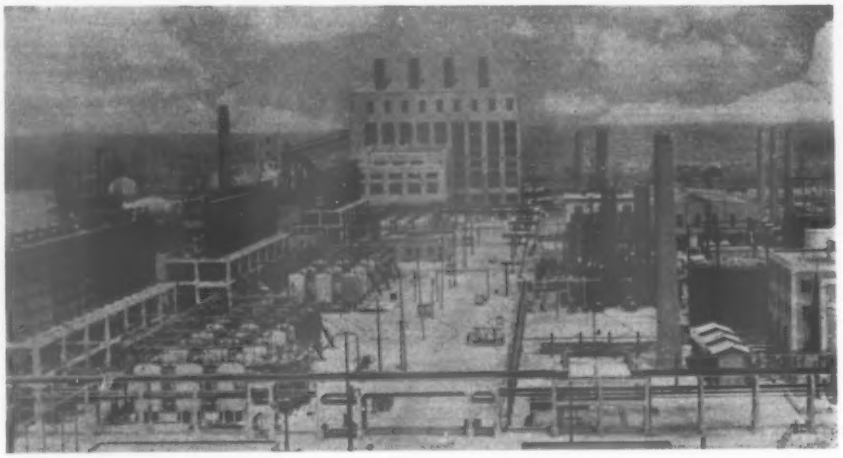
Assuming a mining cost of $2.50 per ton and an assay value of 45 gal. per ton, shale crude oil would cost $3.20 per barrel. Assuming 60% yield of gasoline as the only end product, the cost would be $0.14 to $0.15 per gallon.

The first conclusion is that none of the three methods, with the possible exception of extraction from rich shale, could compete in times of normal world markets with the products from petroleum. In all cases it is found that subsidies in some form or other are granted by governments desirous of building up a national supply for emergency purposes.

From the above it would appear that none of the methods is commercially attractive in the United States at this writing. However, in the light of dwindling petroleum reserves, some course of action would seem imperative in the near future. Experimental work on all three methods is being carried on.

The author would anticipate commercial developments to ensue first from oil from shale on account of lower first cost and lower costs of operation. The other two methods would be available for later development. While the Bergius system offers the lower first cost there are possibilities of adapting the Fischer-Tropsch method to natural gas as a raw material. If such adaptation were successful, the method would probably precede the commercial hydrogenation of coal in America.

New Chemicals Being Produced In Kobuta Butadiene Plant



The 200-acre synthetic rubber materials plant at Kobuta, Pa. On the left of the roadway are three of the four butadiene units, each of which has a rated annual capacity of 20,000 tons. Styrene plant is at the right. Large structure in background is the power plant which supplies all electrical power requirements

IN ADDITION to butadiene and styrene, a number of other chemicals are produced at the Kobuta, Pa., synthetic rubber materials plant. It is one of three in the U. S. making butadiene from ethyl alcohol. Styrene is also produced there, by cracking ethylbenzene. Covering 200 acres, the plant was built by Koppers Co., Inc., for the Defense Plant Corp. and is operated by Koppers' Butadiene Division for the Rubber Reserve Co.

Ether, recovered from the by-product oils of butadiene manufacture, is being used to replace ethyl alcohol in the production of styrene. A plant now under construction at Kobuta will recover ethylene gas, which will also be used in producing styrene and will replace more alcohol. This plant is expected to be in operation in April.

"With the ethylene gas to be recovered by this plant and with the ether being recovered from the by-product oils being substituted for ethyl alcohol, Kobuta will be self-sufficient insofar as the alcohol requirements for tyrene are concerned," stated Dan M. Rugg, vice president, of Koppers' butadiene division. "It is estimated nearly 10,000,000 gal. annually of alcohol will be saved."

Another chemical produced is toluene, of which from 50,000 to 60,000 gal. a month are recovered at Kobuta as a by-product of the production of styrene. This toluene goes into the manufacture of TNT and aviation gasoline. There has also been a recovery of secondary butylbenzene, which has been shipped to various oil companies for blending in aviation gasoline. Large quantities of polyethylbenzene have also been recovered. This has been supplied to companies using the alkylation process, as feed stock for the production of ethyl benzene.

In addition, during the period from June through November, 1944, some 16,000,000 pounds of ethylbenzene were produced for use in the aviation gasoline program. At present, due to a shortage of benzol, Kobuta is producing only enough ethylbenzene to fill its own requirements for styrene production.

Some quantities of dicyclopentadiene and xylene, the latter used as a solvent, are also produced during the manufacture of butadiene and styrene. These have been supplied to various chemical companies.

Other chemicals, such as butanol, and other gases are being experimentally produced at Kobuta, for some of which uses and markets are known. Others are entirely new chemicals, the end uses of which have to be determined. Research is being conducted at Kobuta, Mellon Institute and elsewhere to determine uses for these new chemicals.

As research results in the discovery of other chemicals, together with uses and markets for them, still further products will be made from the residual by-product oils and gases now being used as fuel in the process furnaces at Kobuta.

From July, 1943, when first production began, up to Dec. 31, 1944, more than 153,000 tons of butadiene were produced at Kobuta through the catalytic conversion of ethyl alcohol. Four butadiene units, each with a rated annual capacity of 20,000 tons are in operation. During January, 1945, because of higher requirements for synthetic rubber and the diversion of butylenes to aviation gasoline, the butadiene units were operated at slightly better than 160% of rated capacity.

The styrene production plant, with an annual rated capacity of 37,500 tons, has been in operation since late in August, 1943, and to Dec. 31, 1944, had produced more than 38,000 tons of styrene.

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Refresher on WARTIME REFINING TECHNOLOGY

This book, prepared at the suggestion of Warren C. Platt, Editor of NPN, from overseas fronts where he is an NPN war correspondent, was published primarily for refining technologists serving in the armed forces of their country . . . . to help them catch up quickly on the developments taking place in their absence. NPN is making a copy of this book available, no charge, to each such serviceman through the executive heads of refinery operating companies.

An immediate demand arose from other men who learned of the publication of the book and it is, therefore, being offered for sale to those who are not eligible, as servicemen, for free copies.

This book—REFRESHER on WARTIME REFINING TECHNOLOGY—contains concise descriptions, with flow diagrams, of the new and improved processes—catalytic cracking, manufacture of high octane blending agents, butadiene, synthetic rubber, toluene, and lubricating oils. In addition, it reviews developments in research and covers important new test methods. Included also is an Appendix, listing refineries, natural gasoline, cycling and other plants contributing to the production of aviation gasoline, synthetic rubber, toluene and lubricating oils; and a reference reading list of several hundred articles and papers.

Some of the uses that have been suggested for the REFRESHER on WARTIME REFINING TECHNOLOGY book are: textbook, as part of a training program for technical men newly entering the field of petroleum refining . . . . a "catcher-upper" for men actively engaged in refining technology but compelled, by the emergency, to limit their reading research to a very restricted part of the whole program . . . . a distinct help to operating men who desire to broaden their knowledge of technical developments . . . . a memento for those who participated in these history-making developments.

The REFRESHER on WARTIME REFINING TECHNOLOGY is a convenient, pocket-size book, 4½ x 6¾ contains over 100 pages, durable covers $1.25

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here's the **OTHER HALF** *of the story* (see preceding page)

on WARTIME REFINING TECHNOLOGY

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By N.P.N. Special Writer

This series consists of brief, technical-economic discussions of several new developments in scientific and industrial circles which may relate to the future of the petroleum industry.

Among the subjects upon which attention has been focused in recent weeks are synthetic rubber, a "gasless" automobile, aromatic hydrocarbons, power alcohol, patent developments, and Texas natural gas.

The author of this series is a chemical engineer in the research subsidiary of one of the larger oil companies. His duties include a continuous survey of the current technical and economic journals in the many fields now related to the petroleum industry.

Synthetic Rubber, Postwar

The recent meeting of rubber experts from the Netherlands, the United Kingdom, and the United States, held in Washington under the auspices of the State Department, has served to high light again the coming struggle between the synthetic elastomers and their brother, crude rubber. No formal agreement was sought at this time, the meeting being held to facilitate factual studies, but the figures released by these experts clearly indicate the complexity of the problem.

According to these experts, a possible world surplus of about 1,300,000 tons of "rubber" per year may be expected in three or four years after the liberation of the East Indies and Malaya. Coincidentally, this figure is identical with their estimate for the postwar capacity for producing synthetic rubber.

F. B. Davis, Jr., chairman of the United States Rubber Co., has also made a recent statement on this subject.[1] According to Mr. Davis, it will take five years to restore natural rubber plantations to capacity production, although output might reach 600,000 tons per year after the first year following recapture of natural rubber areas. Annual world demand for all elastics will approximate 1,500,000 tons, he believes, far below the combined capacity for natural and synthetic rubber production, but he urges that synthetic rubber production should be maintained on more than a standby basis.

"The American public is intelligent enough to know that this cannot be accomplished merely by having standby plants which do not operate. Such plants have a way of being neglected and forgotten and finally disposed of. The average voter is going to demand the continued operation of at least a portion of the synthetic rubber plants. It seems reasonable to assume that that portion will amount to at least 200,000 tons of GR-S (the type of synthetic rubber which forms the major part of the government's rubber program). We don't see how this quantity can amount to more than 600,000 tons, for it is estimated that only 600,000 of the 1,000,000 tons GR-S producing capacity in the U. S. and Canada can be produced at low cost.

"If these figures are right, then the future world demand for synthetic rubber of all types will be between 300,000 and 700,000 tons, and the demand for natural rubber will be between 800,000 and 1,200,00 tons."

According to another recent article,[2] as much as 483,000 tons of natural rubber may be produced in 1946 if rubber producing areas are recaptured by late 1945, and the U. S. if it chooses, may receive as much as 300,000 tons of this total. If this eventuates and synthetic rubber plants are running at their capacity of more than 1,000,000 tons per year, domestic supplies next year may greatly exceed expected domestic demands for about 850,000 tons, and it would seem that a decision on the future of the synthetic rubber industry may not be as long postponed as is usually imagined.

According to these last calculations, as much as 1,155,000 tons of natural rubber could be produced in 1947, of which the U. S. could probably receive 700,000 tons. This figure, added to the more than 1,000,000 tons of synthetic rubber production, would be doubled the estimated demands of 850,000 tons.

The petroleum industry has a double stake in the future of the synthetic rubbers. As indisputable producer of the lowest cost raw materials, the industry owes it to the nation to see that political blocs do not legislate against the use of petroleum hydrocarbons as a raw material, a measure advocated by some ill-disguised conservationists.

Secondly, it owes it to the nation to see that certain starry-eyed internationalists do not throw into discard at least those parts of the synthetic rubber industry which can compete with natural rubber on an even basis, for this country must never again rely solely on foreign lands for so vital a raw material.

A third stake exists—the desire for profits—but this is no crime as long as this country operates under the capitalistic system. It is true, however, that postwar profits in this field are not certain, but that is no reason for barring the petroleum industry from competition.

Gasless Automobile

Rumors continue to circulate[3] on the "gasless, clutchless auto, which its Los Angeles inventor claims will run on a 'pale green secret fluid.'" Henry J. Kaiser is reported to be negotiating with its inventor, Frank Perry, but Kaiser's headquarters has refused to make any preliminary public announcement.

The car is said to require no gear shift, radiator, fan, carburetor, ignition, flywheel, clutch, or starter, and it uses only one quart of oil per year and one quart of "secret fluid" every 1500 miles. It is said to get 70 miles per gallon (using kerosine, Diesel oil, butane, or gasoline) by heating and vaporizing the "pale green secret fluid." The power plant of the experimental model consists of a pressure boiler and a 65-pound, V-shaped, 4-cylinder, 30-HP engine. The motor turns over at 800 rpm at 40 miles per hour, compared with 2000 rpm for the standard gasoline engine at the same speed.

Two control levers are used, both mounted on the steering quadrant, one for reversing and one for throttle. Speeds may vary from one to 75 miles per hour. One engineer who checked the car decided that it has some possibilities as a "war emergency car", but that its light, complicated engine could not stand road strain and would get out of order frequently.

Even while considering Kaiser's offer, Perry has acquired a partner

[1] Anon., *Wall Street Journal* **CXXV**, No. 25, 3 (1945), "Experts See World Rubber Surplus in Few Years After War; Davis Urges Synthetic Plants Be Kept."

[2] Anon., *The United States News* 18, No. 5, 22 (1945), "Role of Synthetic Rubber as Postwar Rival of Crude."

[3] Anon., *Business Week*, No. 801, 19 (1945), "Clutches Car Draws Kaiser's Interest"; No. 803, 76 (1945), "To Unveil Gasless Car."

to help him in the business of selling blue prints and building instructions to individuals, at a probable price for prints and parts of about $200.

According to a prominent automotive engineer, Perry's car is probably "a reversion to the steam drive which began in 1902 with the Locomobile (two-cylinder, double-acting), followed by the White, Stanley Steamer, and, finally, by the abortive Doble. All of these cars lived up to the same specifications, requiring no gear shift and, when noncondensing (as were most of the early ones), no radiator, fan, carburetor, ignition, clutch, or starter, although most of them used a very light flywheel.

"A 30-horsepower engine, as indicated, could probably get 70 m.p.g. in flat country, but it would not do it in this (hilly) part of the country, nor would it climb some of the hills. Personally, I would not give much for a steam engine that weighed two pounds per horsepower. It must be made up of tomato cans. The minimum we have been able to get to in steam turbines is 16 pounds per horsepower.

"Nothing is said about the probable troubles with boiler water through which we traveled for some 20 or 30 years with the older steam cars. Stanley finally made his cars at least partially condensing in order to avoid these difficulties."

It would appear that more concrete information will be required before the petroleum industry can decide whether or not this car is another of those models which were going to put other cars "out of business"—but didn't. Engineers have speculated, from time to time, on the possibilities of returning to automotive steam power plants, which admittedly have certain advantages (along with many drawbacks), and it is possible that Perry's car may be a bona fide opening wedge in such a move, but it certainly is not necessary to decide now whether or not this car will drastically reduce the sale of petroleum products.

Aromatic Hydrocarbons

Petroleum is so often regarded as a mixture of aliphatic (straight-chain) hydrocarbons that it is somewhat of an effort to realize that it is now serving as the important source of such aromatic (cyclic) hydrocarbons as toluene and that it may, in the future, supplement and supplant the production and uses of other aromatics now derived chiefly from coal tar and light oil.

John M. Weiss[4] recently presented an interesting discussion in regard to three of the important cyclic compounds—naphthalene, benzene, and toluene. In regard to naphthalene, he reports that 160,000,000 pounds of crude naphthalene were produced domestically in 1940 and that, had all the available coke oven tar been processed, a total of 300,000,000-350,000,000 pounds could have been obtained. In that same year, the naphthalene required for the production of phthalic anhydride approximated 58,000,000 pounds, well within the capacity of the coal tar industry.

The present war has sharply stimulated uses for phthalic anhydride, such as those for the alkyd resins and the phthalic esters required as plasticizers for smokeless powder and plastics and as insecticides. Estimates of 1944 production of these esters range from 130,000,000 to 135,000,000 pounds; the crude naphthalene requirement was in the neighborhood of 160,000,000 pounds. Refined naphthalene uses other than that for phthalic anhydride amounted to 80,000,000 pounds in 1942, or a crude requirement of 100,000,000 pounds; thus, with no increase in these uses, the 1944 requirement for crude naphthalene was at least 260,000,000 pounds, "or well over 60% of the total naphthalene which the coal byproducts industry could furnish if it worked all tar to the limit, and a larger proportion of the naphthalene than could be obtained economically at the present price level."

Weiss has pointed out that a recession in coke oven activity, probably after the war, would not provide sufficient domestic naphthalene to supply the phthalic anhydride plants now operating or being built. Significant imports of naphthalene after the war are not likely, and the only solution on the horizon which Weiss can see is the use of the chemical, orthoxylene, which is produced in large quantities, along with toluene, by "controlled cracking of petroleum hydrocarbons." Like naphthalene, this compound "can be oxidized by air to phthalic anhydride, and its use in present plants appears to offer little difficulty. . . . Indications are that it can be marketed on a basis to compete with naphthalene." Presumably, this is the process being used in the phthalic anhydride plant being constructed by the Standard Oil Co. of California.[5]

Incidentally, another source[6] estimates that the alkyd resins alone will require 70,000,000 to 90,000,000 pounds of phthalic anhydride per year in the postwar period. The Armed Forces are now using some 30,000,000 pounds per year in insecticides, but this is possibly a purely wartime use. Of the 154,385,000 pounds (net resin content) of alkyd resins produced in 1943, it is estimated that 153,398,000 pounds went into protective coatings, 514,000 pounds were used by the textile industry, 291,000 pounds were used for molding and casting, and 182,000 pounds went into miscellaneous uses.[7]

A postwar shortage of benzene is also possible, according to Weiss, since the installed capacity for the synthesis of phenol has grown from 72,000,000 pounds in 1940 to the neighborhood of 235,000,000 pounds in 1944. This later capacity would require around 32,000,000 gallons of benzene per year, or a little less than the actual total production of pure benzene in 1940.

The entire coke-oven light oil supply is already being worked to give as much benzene as can be produced, probably around 150,000,000 to 160,000,000 gallons per year, but the war-initiated styrene program (for synthetic rubber manufacture) requires about 55,000,000 gallons for year, and an "additional purely wartime use" (probably cumene manufacture for aviation gasoline) has absorbed all available excess material and could use more, it is said.

"Benzene can be produced by cracking petroleum with somewhat more difficulty than when toluene is made. So far, the economics of benzene production are not as clear as in the case of toluene, so that it cannot be surely predicted that costs will be of an order to allow unlimited expansion in products based on benzene."

It is obvious that few "coal tar chemicals" can continue to be so termed, and indeed the chemical term "cyclics" is now being applied to these substances, regardless of source. It is equally obvious that petroleum is playing an increasingly important part as a source material for them.

Power Alcohol

In the past, pressure groups have tried, through proposed legislation, to force the use of alcohol as a motor fuel or motor-fuel blending agent, supposedly as a means of increasing farm revenue (at the expense of everyone else). Fortunately, these attempts to legislate an uneconomic practice into existence have failed so far, but it is certain that future ones will be made.

An interesting side light to this issue is the fact that agricultural alcohol interests are at work on ways to make the use of power alcohol more economic. One of these meas-

[4] Weiss, J. M., *Chemical and Engineering News* 23, No. 1, 45 (1945), "Economic Changes in Aromatic Hydrocarbons."

[5] Anon., *NATIONAL PETROLEUM NEWS*, Technical Section, 36, No. 36, R-587 (1944), "Keeping Up With The News—Phthalic Anhydride."

[6] Anon., *Chemical Industries* 55, No. 7, 1000 (1944), "Phthalic Anhydride."

[7] Stenerson, H. W., *Chemical and Engineering News* 23, No. 2, 206 (1945), "Behind the Markets—Synthetic Resins."

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ures concerns the development of an internal combustion engine specially designed to burn alcohol as a fuel. Such an engine is being developed by the Vimilart Corp., although experimental models are said to contain many "bugs" which will have to be eliminated.

This engine was discussed at a recent meeting held in Louisville, Kentucky, at Joseph Seagrams & Sons, Inc.[8] At this meeting, another possible means of making power alcohol economic—at least on a local basis—was revealed. This plan concerns the development of portable distilleries, built in a unit for five railroad boxcars, which could travel to grain elevator sidings to process surplus grain, making the alcohol fuel so produced available to farmers in those areas.

It has been stated that a mobile distillery capable of processing 500 bushels of grain per day would cost about $185,000. Alcohol yields would approximate 2½ gallons per bushel, at an estimated production cost of about 15 cents per gallon; for a 1000-bushel distillery, this cost might approximate 11 cents per gallon. These costs are said to be comparable to those at large distilleries, since transportation costs for the grain (on the order of 8c/bu.) would be eliminated.

A four- or five-trailer unit is also envisioned, capable of going into grain fields far from elevators. In addition to producing power alcohol for local use, such a unit could return 40 to 50% of the grain to the farm for livestock feed.

Such schemes may not be as farfetched as they sound. While production costs of 10 to 15 cents per gallon sound ridiculous to the petroleum industry, which produces gasoline at a refinery cost of 5 to 6 cents per gallon, it must be remembered that transportation costs would not be a factor here, and it is entirely possible, even probable, that a Government subsidy might be forthcoming—such as a remission of tax payments, a device used in England and Germany to encourage the production of substitute (but uneconomic) fuels.

Engineers of Thompson Products, Inc., have also contributed another side light to the picture—a device to apply the well-known process of alcohol-water injection to automotive engines.[9] It is said that a 50-50 alcohol-water mixture appears to be the most economical fluid for injection and that optimum gains are realized with the use of a gasoline of approximately 12 octane numbers lower than the engine's requirements.

All of these developments require some attention from the petroleum industry. There is certainly no question that alcohol can offer little competition to gasoline on an even basis, but there is no certainty that this latter condition will continue to prevail.

Patent Developments

A recent statement made by R. J. Dearborn, president of the Texaco Development Corp., is typical of the progressive attitude of those men who would constructively change, but not destroy the present patent system. It is also of interest in that it proposes a continuance of practices which have greatly advanced the application of science during the war, under the guidance of such Government agencies as PAW and the industry's own Technical Advisory Committee of the Petroleum Industry War Council.

According to Mr. Dearborn,[10] "Many wartime practices are unsuited to peacetime application, but the exchange of technical data and information, desirable in time of war, is also desirable in time of peace, and industry should be encouraged to proceed with such arrangements.

"Patents properly granted to cover technological improvements provide the necessary safeguards to enable exchange of technical data and information between inventors in the same art. In order to encourage all proper exchanges and agreements which tend to promote trade and competition instead of to create monopoly, I favor a clarification of the anti-trust laws to remove the present uncertainty as to the legality of such co-operation, and I favor a statutory provision for the recording with the Government of agreements pertaining to patents and inventions."

Not all proposals made today are by any means as constructive. There are many—even in Government positions—who seem to regard patents as instruments of iniquity and who evidently do not understand that the limited "monopoly" granted by issuance of a patent is payment by the public for eventual public use of the inventive concept disclosed.

If certain proposed patent law changes are adopted, such as compulsory licensing, the result will not be a freer use of new inventions. Instead, such legislation will cause a return to the secret practice of unpatented developments which, because of the necessity for secrecy, will not be publicly discussed in technical papers, and the fundamental scientific data discovered—often useful to other processes and industries—will not be revealed for fear of giving competitors a clue.

There is nothing irrevocably unchangeable and holy in our present pattern system. Possibilities for abuse exist. Many patents granted appear invalid for lack of invention. Changes in the system are certainly required, but they should be made with the intent of advancing science and invention and not with a desire to "punish" the inventor or the company which employs him.

Texas Natural Gas

The nation's petroleum industry is today paying close attention to developments in Texas concerning natural gas. Plans are afoot there, in certain quarters, to limit the use of natural gas to domestic (state) industries, forbidding exports. Under the guise of seeking conservation, other groups are supporting these plans—especially such "conservationalists" as the coal and manufactured gas industries. A proposed Federal Power Commission survey of the gas industry is said to be influenced by similar pressure groups.

The situation, admittedly, is worthy of careful analysis. If all the contemplated pipe lines to carry Texas natural gas to the far corners of the nation are built, they would constitute an additional export demand (from Texas) of 400 billion cubic feet per year and would raise total consumption (from Texas production) to two trillion cubic feet per year. An estimate of Texas reserves at 60 trillion cubic feet (probably less than half of what will eventually be discovered) would indicate at least a 30-year supply, but local industries are (probably correctly) fearful that higher prices for the gas might ensue.

Other groups have pointed out that had such strict restrictions been placed upon the use of Texas petroleum they would have hampered, not aided, the growth of Texas industries. Colonel Ernest O. Thompson of the Texas Railroad Commission reports that the waste of natural gas in Texas is now only 2% of gas produced, compared with wastage of 37% in 1935, hence that conservation is being practiced.

Many industries have a stake in the outcome of this question. Affected directly are the carbon black industry and the (potential) Synthine process industry, although these have a lesser interest than the many industries throughout the nation which depend upon cheap natural gas for fuel or which, if barriers are not imposed, may eventually so depend. Future developments should be carefully watched.

[8] Stenerson, H. W., *Chemical and Engineering News* 23, No. 2, 168 (1945), "Technologists Discuss Power Alcohol Developments."

[9] Colwell, A. T., Cummings, R. E., and Anderson, D. E., *NATIONAL PETROLEUM NEWS, Technical Section*, 37, No. 6, R-88 (1945), "Alcohol-Water Injection as a Detonation Depressor in Gasoline Engines."

[10] Anon., *Wall Street Journal CXXV*, No. 31, 3 (1945), "Voluntary Exchange of Technical Data in Peacetime is Urged."

Liquid Densities of Volatile Hydrocarbon Mixtures

By George H. Hanson, Blaine B. Kuist and Geo. Granger Brown

The use of apparent densities for methane and ethane in the liquid phase, suggested by Standing and Katz for estimating the density of crude oil saturated with natural gas at high pressures, has been extended to liquid mixtures of volatile hydrocarbons as found in natural gasoline.

The modified expansion factor method suggested by Gamson and Watson also appears satisfactory for estimating the density of a complex liquid mixture such as natural gasoline from the composition of the mixture.

METHODS for estimating the density of gases from the theorem of corresponding states and from the use of partial molal volumes have proved satisfactory. Sage, Hicks, and Lacey [1] have suggested a method of using partial molal volumes for computing the density of hydrocarbon liquids. Within the range covered by the data, the results agree within about 3% of the experimental values. However, the composition range is limited to about 10 weight per cent of methane, and consequently this correlation does not cover the low molecular weight liquids similar to natural gasoline and liquefied petroleum gases.

Standing and Katz [2] presented a method for computing liquid densities assuming additive volumes for all compounds less volatile than ethane and using apparent densities for methane and ethane in the liquid at 60° F. and one atmosphere pressure. These apparent densities were given in the form of a chart (Fig. 1) as a function of the weight per cent of ethane or methane in the mixture containing ethane or methane plus less volatile components respectively and the density of the remainder (less volatile) of the liquid. This method is convenient and was demonstrated to be reliable within about 1.5% in predicting the densities of saturated crude oils in equilibrium with natural gas.

Watson [3] presented a method for estimating the density of a pure compound from its molecular weight, critical temperature and pressure, and an expansion factor. Gamson and Watson [4] developed the application of these expansion factors to solutions based on Equation 3 of Watson's original article[3] expressed by the following Equation 1.

$$V=\frac{1}{\omega'}\left[\frac{\omega_{A1}}{\rho_{A1}}m_A+\frac{\omega_{B1}}{\rho_{B1}}m_B+\frac{\omega_{C1}}{\rho_{C1}}m_C+\ldots\right] \quad \ldots\ldots\ldots\ldots (1)$$

where:

V = volume of liquid solution of mass $m_A + m_B + m_C + \ldots$ at the temperature T and pressure P.

ω' = expansion factor for entire mixture at T and P.

ω_{A1} = expansion factor of component A at the reference condition of temperature T_{A1} and pressure P_{A1} where its density is ρ_{A1}.

Calculated densities using this equation were reported by Gamson and Watson to deviate less than 5% from the data on binary liquid systems reported in the literature.

In the course of other work it was possible to determine the liquid densities of a number of mixtures containing the volatile paraffin hydrocarbons from methane through hexane. The liquid mixture was prepared synthetically in a bomb under pressure in a thermostat. A steel pycnometer, previously filled with mercury and weighed, was also maintained at constant temperature in the thermostat. The liquid mixture was transferred under pressure to the pycnometer by displacement with mercury, and the pycnometer was then detached and weighed. The hydrocarbon liquid was analyzed in a Podbielniak low temperature fractionation column. The undisplaced mercury in the pycnometer was collected and weighed.

The liquid density at the temperature and pressure in the pycnometer was calculated from the volume and the weight of the sample. The volume of the sample was computed from the total volume of the pycnometer and the volume of the undisplaced mercury. The weight of the sample was computed (1) from the results of the fractional analysis made on the entire sample and (2) from the weights of the pycnometer filled with mercury, the mercury displaced, the pycnometer filled with sample and undisplaced mercury, the undisplaced mercury, and the weight of the empty pycnometer. The weights based on the fractional analyses proved to be the more accurate, and the densities calculated from these values are reported.

Conditions of Tests

Table 1 gives the compositions of the various liquid samples in terms of mole fraction, the temperatures and pressures at which the densities were measured, and the experimental densities in grams/cc. It includes the densities computed by the method of apparent densities suggested by Standing and Katz [2] using an extension of their pressure correction chart (Fig. 3) and the temperature correction chart (Fig. 4). The table also gives the pseudo critical temperatures and pressures, the Watson expansion factors, and the densities calculated by the modified expansion factor method of Gamson and Watson [4].

According to Standing and Katz [2] the density of the liquid is computed at 60° F. and one atmosphere pressure using the densities of the pure components as listed below and the apparent densi-

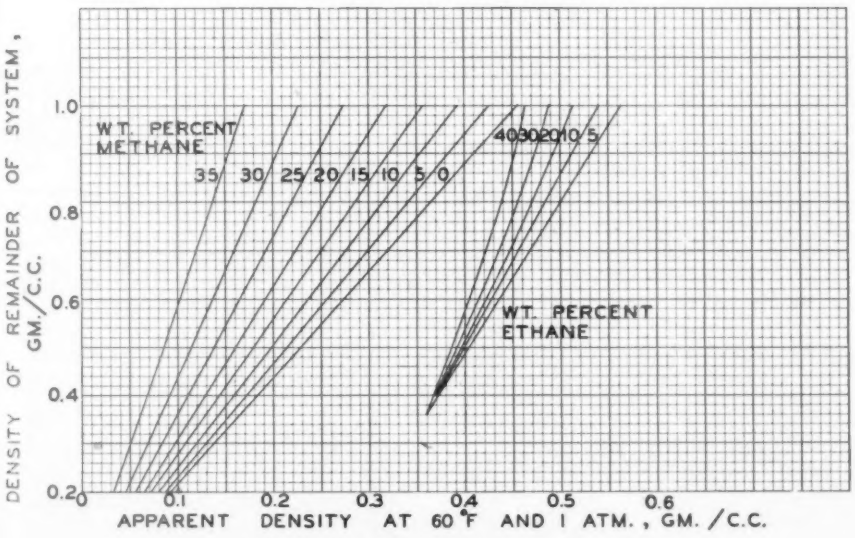

Fig. 1—Apparent density of ethane and methane

This article was originally presented as a paper before the Petroleum Section of the American Chemical Society at its 106th meeting in Pittsburgh, Sept., 1943, and is reprinted from Industrial and Engineering Chemistry with permission of the society. *Of the authors, Mr. Hanson is presently associated with Phillips Petroleum Co. and Mr. Kuist with Standard Oil Co. of Cal. Dr. Brown is chairman of the Department of Chemical and Metallurgical Engineering at the University of Michigan, Ann Arbor.*

TABLE 1

Sample	1	2	3	4	5	6	7	8	9
Mole Fraction									
C_1H_4	0.5574	0.3858	0.4512	0.3472	0.4199	0.1479	0.2866	0.3838	0.5251
C_2H_6	.1222	.1314	.1308	.1325	.0752	.0438	.0718	.0756	.0727
C_3H_8	.1369	.1755	.1490	.1893	.0681	.0814	.0780	.0705	.0597
n-C_4H_{10}	.....	.....	.....	.....	.1055	.1522	.1323	.1129	.0840
n-C_5H_{12}	.0851	.1449	.1256	.1613	.3313	.5747	.4313	.3572	.2585
n-C_6H_{14}	.0984	.1624	.1434	.1697	.....	.....	.....	.....	.....
Molecular Weight	33.27	42.32	39.16	44.16	42.03	57.59	49.01	43.87	36.77
Pseudo T_c, R.	512.0	592.9	563.7	610.0	592.3	732.0	656.2	609.3	543.4
Pseudo P_c, psia	630.7	602.4	612.0	596.8	596.9	543.5	574.2	591.0	613.7
Pseudo T_r	1.049	0.906	0.953	0.874	0.945	0.765	0.853	0.919	1.031
Pseudo P_r	3.880	3.373	2.977	2.748	3.786	0.951	1.693	2.195	2.829
Temperature, °F.	77	77	77	73	100	100	100	100	100
Pressure, psia	2447	2032	1822	1640	2260	517	972	1297	1736
Exptl. Density, grams/cc.	0.385	0.480	0.456	0.469	0.454	0.553	0.500	0.470	0.406
Computed Density[2]	0.378	0.486	0.445	0.495	0.460	0.556	0.506	0.466	0.369
Per cent error	—1.8	1.2	—2.4	5.5	1.3	0.5	1.2	—0.9	—9.1
Watson Expansion Factor	0.086	0.100	0.094	0.102	0.097	0.109	0.101	0.096	0.085
Computed Density[4]	0.377	0.470	0.434	0.487	0.455	0.543	0.489	0.453	0.384
Per cent error	—2.1	—2.1	—4.8	3.8	0.2	—1.8	—2.2	—3.6	—5.4

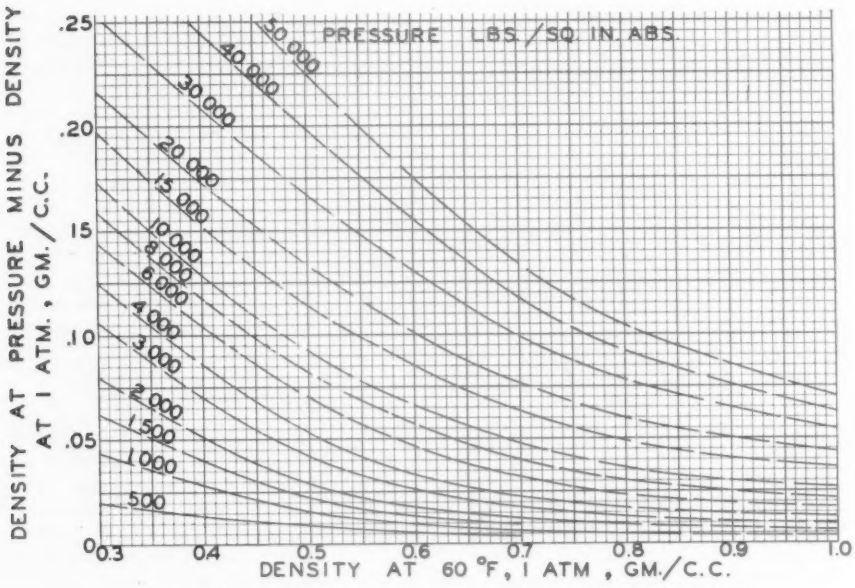

Fig. 3—Effect of pressure on the density of liquids at 60° F.

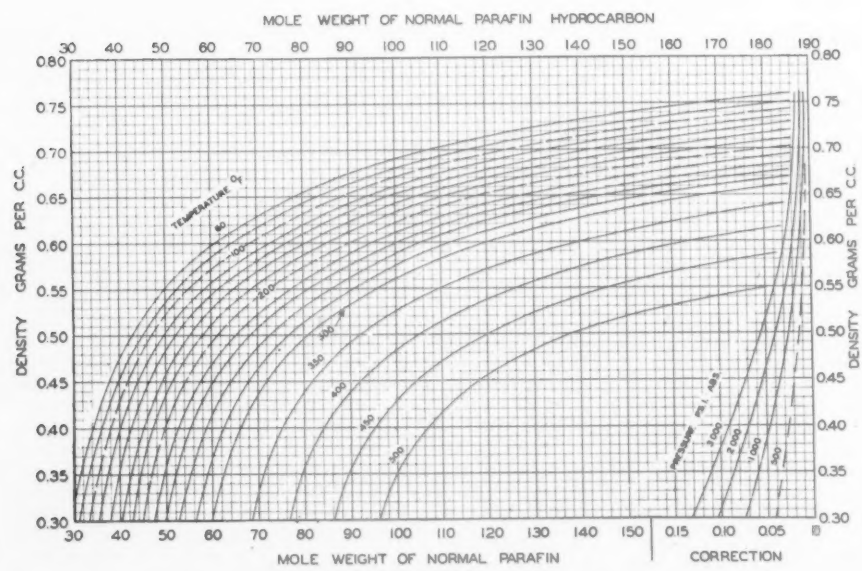

Fig. 4—Effect of temperature on densities of liquid normal paraffins.

ties for ethane and methane indicated in Fig. 1.

	Density at 60° F.
C_3H_8	0.510 grams/cc.
i-C_4H_{10}	0.564
n-C_4H_{10}	0.584
i-C_5H_{12}	0.625
n-C_5H_{12}	0.631
n-C_6H_{14}	0.664

The density of the liquid exclusive of the dissolved methane and ethane is computed at 60° F. and one atmosphere pressure using the densities of the individual compounds. The apparent density of ethane is then determined from Fig. 1, using the density of the liquid exclusive of methane and ethane and the weight per cent of ethane in the "ethane plus." A similar procedure is followed for the methane to compute the density of the entire liquid.

A somewhat simpler but less accurate procedure is incorporated in the use of Fig. 2 instead of Fig. 1. The density of the liquid exclusive of the dissolved methane and ethane is computed as before. Using this density as the density of the remainder of the system, Fig. 2 is entered at the top. Follow this abscissa down until it intersects the line corresponding to the weight per cent of ethane in the liquid including ethane and less volatile components but excluding the methane. Read the density of this liquid as indicated along the left-hand ordinate. Use this density as the point of entry at the bottom of Fig. 2. Follow the abscissa vertically to the indicated weight per cent of methane in the total liquid and read the density of the total liquid along the right-hand ordinate.

The density of the total liquid at 60° F. and one atmosphere pressure is corrected for the effect of pressure by Fig. 3. The temperature correction is then made with Fig. 4 or by the use of the N. G. A. A. Standard Factors for Volume Correction [5]. The results obtained using the N. G. A. A. Standard Factors on all mixtures whose densities at 60° F.

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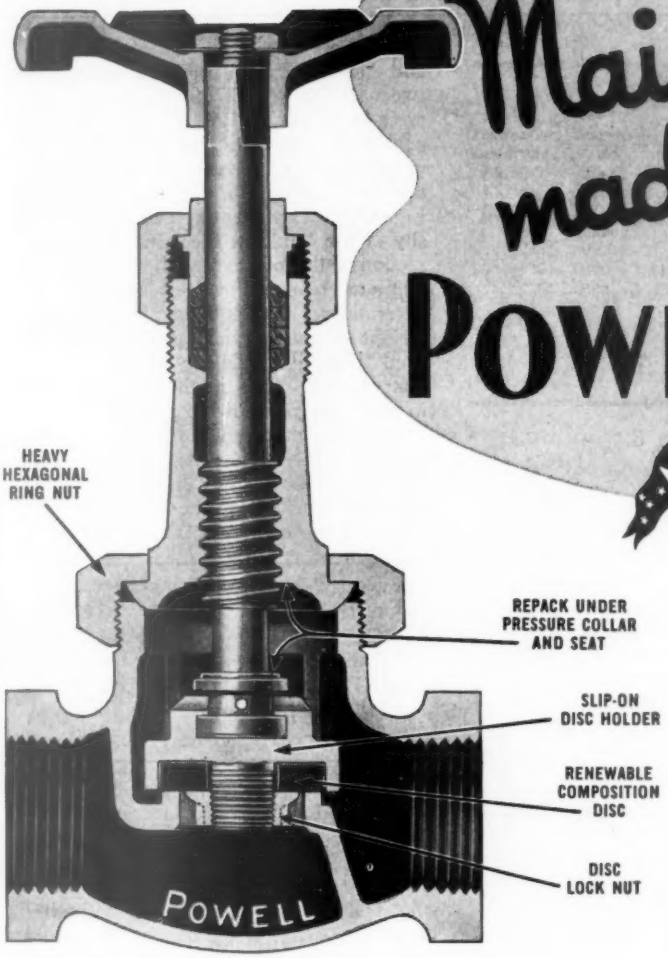

Fig. 150
BRONZE "UNION" COMPOSITION DISC GLOBE VALVE

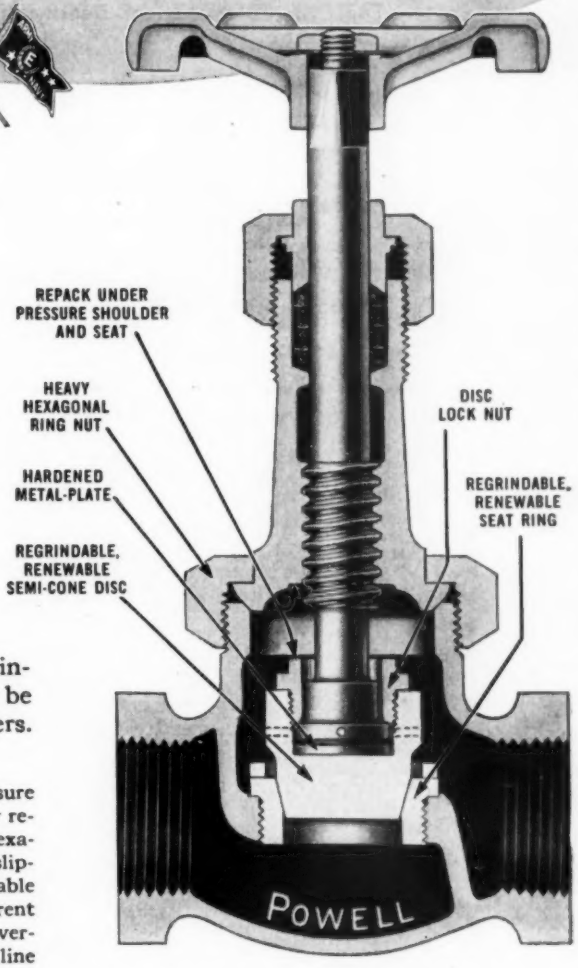

Fig. 1708
BRONZE "WHITE STAR" GLOBE VALVE

In these days of round-the-clock operation, time spent in the maintenance of equipment means a loss in production that can never be made up. If it's flow control equipment, Powell has the answers. Here are two examples.

Fig. 150—a Union Disc Globe Valve—is an economical valve for low pressure steam, oil, water, gas or air. The composition disc can be quickly and easily replaced without removing the valve from the line merely by backing off the hexagonal ring nut, lifting the bonnet assembly out of the body and removing the slip-on disc holder. The discs, especially for the smaller sizes, are readily obtainable and very inexpensive. Discs of various compositions are available to meet different service conditions and the importance of using the *right* disc cannot be overemphasized. The seat can be refaced without removing the valve from the line as indicated above.

For *extra long life,* Fig. 1708 is recommended. The seat ring and disc are made from special hard metal compositions. The hardness of the seat and disc, with their wide contact surface, tends to resist erosion and corrosion over a long period of time. Without removing the valve from the line, seats and discs can be reground to a new tight bearing and, when necessary, new ones can be easily installed. No special tools are required.

All Powell Valves that require repacking are provided with a specially machined cut-off to permit repacking under pressure when wide open.

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Dependable Valves Since 1846
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POWELL VALVES

TABLE 2—Calculation of Density of Sample 8

	Mole Fraction	Weight Grams	Cum. Wt. (upwards)	Weight Per Cent	Density Grams/cc. 60°F.-1 atm.	Volume cc.	Volume Cum. cc. (upwards)
C_1H_4	0.3838	6.16	43.87	14.04	0.220†	28.00	91.44
C_2H_6	0.0756	2.27	37.71	6.01	0.435*	5.21	63.44
C_3H_8	0.0705	3.11	35.44	.....	0.510	6.10	58.23
n-C_4H_{10}	0.1129	6.56	.....	.....	0.584	11.23	.....
n-C_5H_{12}	0.3572	25.77	.....	.....	0.631	40.90	.....

*Density of $C_3^+ = 35.44/58.23 = 0.609$; Fig. 1 gives apparent density $C_3 = 0.435$.
†Density of $C_2^+ = 37.71/63.44 = 0.595$; Fig. 1 gives apparent density $C_1 = 0.220$.
Density of $C_1^+ = 43.87/91.44 = 0.480$ at 60° F. and 1 atmosphere.
Density at 1297 psia and 60° F. = 0.480 + 0.022 (from Fig. 3) = 0.502.
Density at 1297 psia and 100° F. = 0.466 (from Fig. 4)
0.502 × 0.9278 = 0.466 (by N.G.A.A. Factors)

TABLE 3—Calculation of Density of Sample 8

	Mole Fraction	Weight Grams	Pseudo T_c, R.	Pseudo P_c, psia
C_1H_4	0 3838	6.16	132.0	258.3
C_2H_6	0.0756	2.27	41.6	53.8
C_3H_8	0.0705	3.11	47.0	43.5
n-C_4H_{10}	0.1129	6.56	86.5	62.2
n-C_5H_{12}	0.3572	25.77	302.2	173.2
	1.0000	43.87	609.3	591.0

Pseudo $T_r = 560/609 = 0.919$ Pseudo $P_r = 1297/591 = 2.195$

Using Fig. 1 of Watson's original article [3] the expansion factor for the entire mixture at 1297 psia and 100° F. equals 0.096.

$$V = \frac{1}{0.096}\left[\frac{6.16}{3.35} + \frac{2.27}{4.42} + \frac{3.11}{4.75} + \frac{6.56}{5.04} + \frac{25.77}{5.16}\right] = \frac{9.304}{0.096} = 96.92 \text{ cc.}$$

Density = 43.87/96.92 = 0.453 grams/cc.

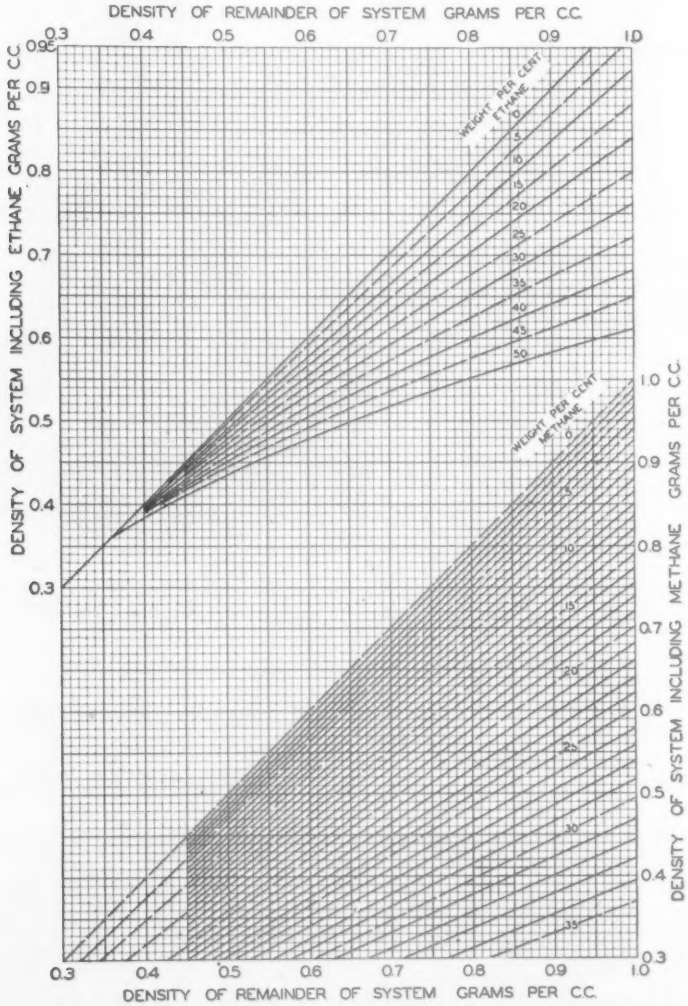
DENSITY OF REMAINDER OF SYSTEM GRAMS PER C.C.
DENSITY OF SYSTEM INCLUDING ETHANE GRAMS PER C.C.
DENSITY OF SYSTEM INCLUDING METHANE GRAMS PER C.C.
WEIGHT PER CENT ETHANE
WEIGHT PER CENT METHANE

Fig. 2—Graphical calculation of liquid densities at 60° F. and one atmosphere pressure

and the indicated pressures were between 0.500 and 0.700 (the range covered by the N. G. A. A. Factors) were nearly identical with the results obtained using Fig. 4. Consequently, these values are not reported in Table 1. In using Fig. 4 the chart is entered using the density of the liquid at the left. The intersection of this ordinate with the indicated temperature curve, in this case 60° F., determines the equivalent molecular weight of the normal paraffin which is used to read the density at the desired temperature. The method is indicated in the example shown in Table 2.

In the modified expansion factor method of Gamson and Watson [4] the following values of ρ_1/ω_1 calculated from the densities at the normal boiling points of the components are used:

Component	ρ_1/ω_1
C_1H_4	3.35
C_2H_6	4.42
C_3H_8	4.75
n-C_4H_{10}	5.04
n-C_5H_{12}	5.16
n-C_6H_{14}	5.24

Calculation of liquid densities using this method is illustrated in Table 3.

Conclusion

The use of apparent densities[2] and the modified expansion factor method[4] appear reliable for calculating the liquid densities of volatile hydrocarbon mixtures from the composition of the mixtures. The average error in the use of apparent densities in the calculation of the liquid densities of the volatile hydrocarbon mixtures reported herein is −0.5%, and the average error in the use of the modified expansion factor method is −2.0%.

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PROCESS DEVELOPMENT PROGRAM

Standardized Procedure in Developing New Chemical Processes Minimizes False Moves, Guides Efforts Toward Desired Goal, Results in Savings of Time and Money

By H. L. Barnebey

The process development program is aided by resolving it into a definite series of steps. The completion of each step should prove it worthwhile to proceed to the next and should indicate the course of further action. The commercial plant should be visualized before the pilot plant is designed in order that it may be built to supply the requisite data. Mistakes cost less when made early in the program.

In view of the intricate nature of many of the modern petroleum refining processes, the systematic organization of the process development program is recognized as an increasingly important factor in later successful commercial operations. The following discussion of this subject is by a representative of Blaw-Knox Division of the Blaw-Knox Co., which, in the government's synthetic rubber program, engineered the standard design for the GR-S processing plants.

Laboratory Research

IT IS a popular notion that a chemical process begins in the laboratory, in a research chemist's test tube. There are doubtless a few cases in which this has actually been true. A more typical example, however, might be as follows:

A chemist or chemical engineer with a considerable background in a certain field, say organic chemistry, while shaving one morning, thinks of a different way in which to synthesize a particular material. The more he thinks about it the better it seems to him. He can visualize an improved product at a lower cost; but will the idea actually work?

When he arrives at the laboratory he discusses his inspiration with his associates. Some of them think it will work and others are sure it will not. They write out reactions, refer to reference books, plot curves, look up old data from other laboratory tests, discuss it at considerable length and then finally they all agree that maybe it will work if done such and such a particular way. Now our research man begins to think about actually trying out his idea. In some cases this can be simply done, in others special equipment is required and his superior must be convinced that the idea is worth trying before any money is spent.

The conception of a chemical process can take place anywhere. The thought might originate in the laboratory but not necessarily. In general, the conception of an idea and the first trial are two distinct operations. It is, however, often difficult to separate the two. Sometimes the idea starts out one way and after a little experimenting turns out to be something else, just as useful perhaps, but different.

To simplify our thinking, let us lump the idea and the first trial together and call it laboratory research. Let us also include under this heading other experimental work done to prove and improve the process, in glassware and other laboratory equipment. When the work in this category is finished we can make the desired product on a small scale, have some data on yields, the conditions of operation such as temperature and pressure, and have an assortment of pertinent facts relative to the process.

Product Evaluation

The next step is to determine the commercial usefulness of the new product or process. If the product is new or if it had only been available before in small quantities as a laboratory curiosity, then the market must be surveyed to determine if possible what quantities of products could be sold, the probable selling price and whether conditions will change with time. It should be determined in a preliminary way what the probable cost of manufacturing will be. The source of raw materials should be studied, disposition of by-products considered.

Will the new process tie in readily with the company's present operations? Will the new material constitute a valuable adjunct to the company's present line of products or will it turn out to be a sort of ugly duckling? Can it be sold to the same group of industries or customers? Can the present sales organization handle it? Are there special problems relating to packaging or distribution? Will one purity or analysis satisfy all users or must a series of products be marketed? Will an educational advertising program be required to create demand and acceptance?

If it is a new process to manufacture an existing product then it must be critically compared with present methods. Unless real advantages are apparent—lower cost, safer operation, greater purity, more readily obtainable raw materials—there is no reason to proceed further.

A rough estimate should be made at this time of the cost of carrying through the rest of the development program and building the production plant. The patent situation should be carefully analyzed. Will existing patents prohibit the use of the process? Can patent protection be obtained for our new brain child? Although patent considerations are of great importance in every step of the development program, they are doubly important at this stage and can go far toward making or breaking the project.

In general, the purpose of this step which we will call "Product Evaluation" is to decide whether there is a sufficient chance for profitable commercial operation to warrant the expense of further development. This link in the chain is just as important as the first. There is no profit in spending further money on an interesting but commercially useless invention.

Process Study

It is very difficult to establish a clear line of demarkation between what may properly be called laboratory work and that which we will call pilot plant work. At one time, as soon as the research men began to look around for something larger than ordinary glassware for carrying on experimentation, they were prone to say that the process had entered the pilot plant stage. We prefer to consider this next step which we will call "Process Study" as an extension of the laboratory work, with the emphasis being on the functioning of the separate operations from a chemical and technological point of view.

The important point in this phase of the process development is to establish as clearly as possible the actual unit operations which will be involved in making the product on a large scale. For example, we might find that a particular compound is very easily purified by high vacuum rectification in a glass laboratory column, but it may not be practical to carry out the same operation in a one-foot diameter column with commercial packing or bubble cap construction. Again we might find that a product which dried very satisfactorily in a laboratory desiccator becomes quite a problem when we try to handle it in a rotary vacuum dryer.

The work at this stage is essentially

This article was originally presented as a paper under the title "Process Development" at the meeting of the American Institute of Chemical Engineers in Cleveland, May 16, 1944. The author, H. L. Barnebey, is Assistant Sales Manager of the Process Equipment Dept., Blaw-Knox Division of Blaw-Knox Co., Pittsburgh.

qualitative in nature, the object is to find out which of the commercial equipment types or methods are suited to each step of our process. Many large companies have well equipped laboratories for such study. The apparatus was purchased with an eye to flexibility; a distillation column or an autoclave must be used to test out individual steps for many processes.

The necessity for providing for a wide range of physical and chemical conditions places a restriction on the efficiency of the equipment for a specific operation. For example, the use of a particular experimental fractionating column may prove that the product can be handled in that kind of equipment and that steel is a suitable material of construction, but may not give accurate quantitative data for commercial plant design.

In the course of a number of years' work some organizations have managed to accumulate a large number of small distillation columns, autoclaves, dryers, evaporators, and other very useful pieces of process equipment. Frequently, this equipment can also be used to advantage in training new personnel in the use of the various chemical engineering operations.

It should be definitely decided at this time whether the process or the various parts of it should operate batchwise or continuous. This decision will have considerable effect on the type of equipment employed, piping, instrumentation and plant layout. Many chemical engineers consider continuous operation as being so much superior that they look down on anything that functions in batch fashion.

Although there is much to be said on the side of continuous operation, there are many processes with minds of their own—they just do not wish to operate that way. In some instances, batch operation has numerous points in its favor.

Many times a main objective of these studies is to produce larger quantities of material than can be satisfactorily prepared in glassware so that its properties and uses may be more fully explored.

High pressure or high temperature reactions may require special heavy elaborate equipment of a type not ordinarily thought of in the same category as glassware; for instance, hydrogenation at 5000 psi and 700-800° F. temperature. The first trial—to see if the process will work at all—must be carried out in a very expensive apparatus. If the laboratory does not have such equipment on hand, and if it must be built for trying out the new process, then step No. 2, or Product Evaluation, might logically precede the first trial. Why spend $5000 or $10,000 for an autoclave and auxiliary equipment to find out if the process does actually work unless the products to be produced can be sold profitably?

In general, this process study should yield sufficient information so that the commercial plant can be visualized.

Preliminary Engineering

In most companies engaged in chemical process work, there is usually a lively spirit of competition between those technicians who are primarily laboratory or research workers and the men who call themselves chemical engineers. At this step in the development the feeling of, let us say, friendly rivalry, is likely to reach a point of considerable intensity. The research men, having nurtured the process through all the hardships of laboratory manipulation and theoretical investigations, are sometimes reluctant to allow their brain-child to pass into the care of other hands. Chemical engineers are likely to regard the research chemists with considerable suspicion as individuals who attempt to minimize the importance of such small items as pumps and heat exchangers in plant design and who think there are no refrigeration problems that can not be licked with dry ice and acetone.

Assuming that all previous work has established the validity of the process to the extent that our attention can be focused on the design of the commercial plant, it now becomes desirable to work up rather detailed engineering studies. Competent analysts and engineers should make surveys of market locations, plant sites, fuel and water sources, transportation facilities, material and labor supplies, governing laws and codes and other subjects which have bearing on the final plans. Very frequently a single controlling factor will automatically determine numerous other conditions. For example, the process may require a raw material which cannot be conveniently transported. Consequently we have to erect the plant at the source of the raw material and local conditions of transportation, water, fuel and atmospheric temperature will have bearing on the final plant design.

We are frequently asked to design a plant on the basis that the site will be selected later and that it is desirable to get as much of the engineering work accomplished as soon as possible. While in some cases this can be accomplished readily, there are numerous instances where only confusion and delay result from this procedure. It is not always appreciated that the actual process equipment is only a part of the plant and that such things as topography, power, water supply and transportation facilities must be carefully considered in the engineering design of many chemical plants.

As chemical engineers you are all familiar with the steps required in the visualization of the final operating plant. This preliminary design involves the working up of process and design flow sheets, the study of power systems, the development of heat and material balances, the preparation of tentative specifications for machinery and materials, the preliminary sizing and design of pressure vessels, exchangers, and other process units, the drawing of preliminary plant and equipment layouts, and the preparation of cost estimates. This, of course, involves consultation with suppliers of pumps, electrical equipment, control instruments, and many other items which go into the final plant.

We usually design a plant thinking in terms of normal operation but almost every new process undergoes a considerable amount of abnormal operation before it hits a regular stride. It is quite a different thing to start up a new unit than to merely keep the unit running once it is started. Provisions for testing equipment, emergency shutdowns, reduced through-put and other operations out of the ordinary must all be taken into account in the preliminary design and checked when necessary in the pilot plant study.

Since most of the process data desired for plant design must yet be obtained, the successful handling of this phase calls for considerable ingenuity on the part of the chemical engineer. You will notice, nothing has been said up to this time regarding pilot plant study. The particular point to be emphasized is that the commercial plant must be carefully visualized and a considerable amount of tentative design work completed before the pilot plant is engineered and built. The chemical engineer assembles all the information furnished to him by the research department, he thumbs through the literature, he digs into other available sources of information and calls upon his own broad experience to work up a tentative design on a plant that will have to prove itself in commercial competition.

He now prepares an approximate cost estimate for the final plant, as well as a rough design and estimate on a pilot plant to supply the requisite quantitative data. It should now be decided whether the cost of proceeding with the pilot plant and production unit are in line with profits which can be anticipated in commercial operation. We should make our mistakes as early as possible in the program as they cost less that way. In terms of dollars, the biggest jump is always in building the commercial plant. Consequently, we should be assured that it is feasible in every respect before the final steps are taken.

Pilot Plant Study

We have pointed out that a new project is ready for pilot plant study only when satisfactory conclusions have been reached on the general design of the ultimate large plant. There may be some who will not quite agree with this point of view—you may be inclined to consider the pilot plant as a step which proves the research work; whereas in this discussion the pilot plant is considered a means for providing quantitative data for the design of the commercial plant.

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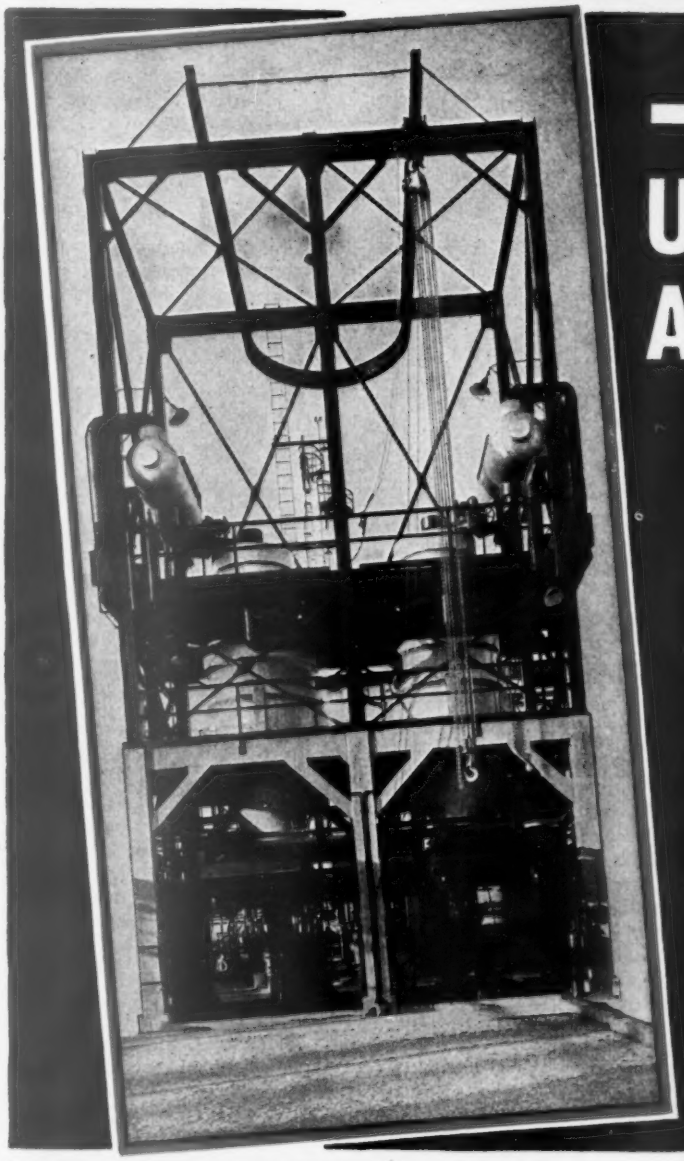

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We know that the separate steps will operate on a small scale. We know something about suitable equipment types. In our pilot plant, we want to operate all the steps together as would be done in a commercial unit and obtain sufficient data to design and build the plant. We list the information which must be obtained and then work out the pilot plant design to give these data. The pilot plant may not resemble the commercial unit in appearance. It is not necessarily supposed to. Its function is entirely different.

The chemical engineer should recognize those points which are likely to cause trouble in the big plant and this should be reflected in the design of the pilot plant. If we have, say, a high pressure autoclave involved in the process, we should definitely establish the feasibility of such a piece of equipment for the particular operation in our pilot plant work. Otherwise, we may have the sad experience of finding that the commercial plant is a large pilot plant which disproves the original design. It is quite evident that a detailed intelligent study of final requirements will bring forth the questions which should be answered in the pilot plant.

Due to the tremendous variation in commercial enterprises which range from small establishments employing two or three men to vast industrial plants employing thousands of workers, the size and complexities of pilot plants are also highly variable. In some cases, it is desirable to carry a process through several complete pilot plants before a very large investment is made in a commercial venture. On the other hand, it is not always necessary to make pilot plant study of all phases of the complete process which is to be followed in making a particular product. That is, the validity of certain phases may be well established and it is necessary to conduct experiments on just part of the proposed operation.

The tendency to underestimate the importance of well-designed and correctly fabricated pilot plant equipment is being rapidly overcome. The very heart of many modern industrial processes is some complex piece of equipment which may operate at high pressures or temperatures. Dependable results and sound data can not be obtained in the pilot plant with makeshift equipment.

The chemical engineer is always striving for a careful balance between the various steps in the process and it is the integration of many complex operations which characterizes pilot plant studies in their most modern sense. Pilot plants must possess as much flexibility as is economically feasible. The nature of the problems which must be solved will necessarily depend on the process being investigated. Sometimes these studies may be centered almost entirely around one topic such as corrosion. Again, the control of reaction rates may be the chief stumbling block. Almost always there are questions concerning suitability of various types of mechanical equipment and the solution of these should not be left until later.

Briefly mentioned, some of the typical information sought is on pressures, temperatures, flow rates, compositions, reflux ratios, drying rates, and heat transfer surfaces; proof of applicability of standard or special types of equipment and machines, such as pumps, filters, evaporators and stills; data on materials of construction such as metals for pressure vessels and piping; data on corrosion rates; data on effect of impurities in commercial raw materials, especially those impurities which tend to accumulate in the system; data on methods of operation and control with regard to instrumentation, location of equipment, manpower requirements and general efficiency; consideration of health hazards and safety requirements; data for determining accurate production costs, probable maintenance expenses, material and utility requirements, peak loads and storage capacity; finally sufficient over-all data to determine if the process as now established will be both efficient and profitable on a commercial scale or if improvements or changes must be yet made before proceeding.

There are certain types of reactions which are difficult to carry out except on something larger than laboratory scale. A good example might be petroleum cracking. For the desired process to work at all calls for equipment of pilot or semi-works size set up with auxiliary equipment, piping, valves, and control instruments—a complete operating unit rather than experimental equipment as discussed under "Process Study." In such cases the process study and pilot plant study might be combined and qualitative and quantitative tests run together. Since the first trial of the new process is in this case a very expensive procedure, we should carry out our process evaluation and preliminary engineering first to rule out possible stumbling blocks before making the investment.

The pilot plant equipment should be designed in such a way that the test results can be translated as directly as possible into commercial designs. A jacketed kettle should not be used if a few calculations will make it obvious that the required heat transfer cannot be obtained except by filling the commercial size vessel with coils. Glass beads should not be used for rectifying column packing if we anticipate using 2-inch Raschig rings on the large scale. A batch apparatus should not be used for pilot work on a continuous process even if it does represent a saving in money.

By following a large number of projects through the various development stages to commercial operation, considerable experience is obtained in translating pilot plant data into commercial design and anticipating large scale problems in pilot equipment design. The greater our experience in making this pilot plant to commercial plant step, the larger that step can be. Certain types of equipment might be stepped up in the ratio of 1000 to 1 as a result of experience without which a 5 to 1 increase might be risky.

The pilot plant is operated by chemical engineers, not by chemists or laboratory research personnel. An excellent opportunity is presented in pilot plant work to train operators for the commercial plant. They will become well acquainted with the process and the type of equipment which they will operate on a large scale. They may have many valuable suggestions as to details, conveniences and safety precautions.

Commercial Plants

We should now have sufficient quantitative information to design, build and operate the commercial plant. Before doing so, however, we will accurately estimate the cost of the project. We will recheck our market analysis and anticipated cost of production. We will make the final decision as to whether the commercial plant will be built — when, where, how large.

The execution of the engineering design, equipment fabrication and plant construction now follows well known courses. The greatest amount of work in terms of manhours, tons of steel, and money still remains to be accomplished but as a result of a well-planned, skillfully executed development program the path now is much straighter. The final goal is a production plant which can manufacture a high quality product in the desired tonnage at a minimum cost and do it day after day, year after year.

The design of commercial equipment from pilot plant data as previously mentioned calls for some skill and experience. One does not just multiply the size of the ratio of production rates. A jacketed reaction kettle may have worked very nicely in pilot tests; but in increasing the capacity from 25 to 2500 gals., the ratio of heat transfer surface to volume may become so low that the required rate of heat transfer cannot be obtained. What looks like gentle agitation in a small vessel may correspond to 100 h.p. in a large one. In converters for exothermic catalytic reactions, one does not increase a 1-in. diameter tube to 10 ins. in diameter, but uses a number of smaller diameter tubes to obtain similar heat removal conditions.

Not infrequently it is necessary to decide whether to obtain the full production in a single plant or build it in several units. Often there is an optimum plant size beyond which it is not feasible to go—if possible this should be decided in the preliminary engineering step since it has a major effect on plant cost. In many instances sufficient information is not available for this decision until after the pilot work is finished.

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ods which can assist in developing a design which not only looks good on paper but operates easily after construction. One of these involves the use of models. By constructing a three-dimensional scale model of the proposed plant in wood, plastics or other easily worked materials, the physical appearance will become more clearly evident. Defects in arrangement will be apparent, visualization of the piping will be easier, location problems can be studied by looking at one view rather than three separate ones on drawings. The operating department can be called in and asked for their suggestions on location of valves, instruments and platforms. The models usually make a hit with company executives who, by the way, frequently contribute some good ideas.

Another helpful procedure is to write the process operating instructions at the time the detailed flow sheet is completed and the equipment operating instructions at the time each piece is designed. This forces the design engineer to have the viewpoint of the operator constantly before him. When instructions are written certain desirable changes usually become evident.

The commercial plant represents a major capital expenditure which must bring results in the form of profitable production. The time for experimentation is past. A company cannot afford to make many mistakes at this stage. If the development work was done well, there is little to fear. There are always problems to be solved in building a chemical plant and putting it in operation—sizeable problems not to be considered lightly. By doing the development work in a business-like and sound engineering manner, we have minimized future trouble.

Summary

Now let us stand back and take a critical look at the sequence we have described. We have divided process development into six separate steps, (1) laboratory research, (2) product evaluation, (3) process study, (4) preliminary engineering, (5) pilot plant study and (6) commercial plant. Let us consider the advantages of doing so. By splitting up a difficult task into a number of parcels the accomplishment is not so formidable. Each step, taken by itself, is relatively simple. By completing one step before proceeding with another, first things are done first, the usual result being economy in time and money.

The gain in knowledge or profit from each step must be commensurate with the cost of that step. From a commercial standpoint, the completion of a step should prove it worthwhile to proceed to the next and should indicate how to proceed.

Make your mistakes as early as possible in the program—they cost less that way. The commercial plant should be visualized before the pilot plant is designed so that it can be built to supply the requisite plant design data. By dividing up a program into a number of definite parts, it is possible to more clearly define the functions in different departments of a company.

There is nothing magical about the six steps. We might have divided the work just as logically into five steps, seven or even a dozen. The point is to have a standard series of steps established for carrying out investigations of this type. Each company engaged in such work will have its own ideas as to how to divide the load. This is frequently closely related to the company's departmental organization.

As in every industry, competition in the chemical process industry is keen. A few months' head start over one's competitors with a new product or process may spell success for the new project. For this reason a development program cannot take a leisurely course but must move with all possible speed. An organized method for handling the work will cut the time required by minimizing false moves.

Each process has unique features which bear on the method of organizing the work. For specific cases, steps might be eliminated, new ones added, or several might be carried on simultaneously. During war-time, for example, speed is foremost, monetary risk secondary. So we might jump from test tube to plant and work out all problems on a large scale—a very costly but sometimes time-saving method. By having a standard procedure in front of us as we progress, our thoughts are clarified, the direction of our steps is guided.

The salient points in our process development philosophy are:

1. A standard series of development steps.
2. Proceed with a step only if proven economically feasible.
3. Visualize the commercial pant before building the pilot plant.
4. Make your mistakes as early in the program as possible.

Navy Seeks Answers to Puzzling Problems

SOMEWHERE in the tremendous background of technical knowledge and practical experience possessed by refinery technologists there may lurk the answers to some of the problems which have been puzzling the U. S. Navy.

Listed below are a few of these problems, for which the Navy Dept. is seeking solutions and which they have turned over to the National Inventors Council.

If you think that you might have the answers to any of them, your suggested solutions should be prepared in sketch and description form and sent to the National Inventors Council, Dept. of Commerce, Washington 25, D. C., for consideration and report.

Chairman of the council is Charles F. Kettering, vice-president in charge of research of General Motors Corp.

A gasoline resistant coating for the interior of gasoline drums and not adversely affected by gasoline.

An oil or liquid knapsack sprayer for use especially in malaria control work in overseas theaters, which, (a) is of simple construction, (b) has easily replaceable and reproducible parts, (c) has a minimum of rubber parts and gaskets, and (d) is light, rugged, durable, leak-proof.

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A continuous sampling combustible gas indicator with automatic alarm which is simple, positive, inexpensive and suitable for installation in gasoline-driven motor boats for continuous sampling of the vapor in the bilges.

Radio antennas up to 300 feet in height that can be set up by unskilled ground crews. The efficiency of radio devices is often limited by the extreme difficulty of obtaining reasonable antenna heights quickly in the field. Very light alloys and special rigs for rapid erection by a ground crew without climbing are desired, in addition to ability to dismantle or collapse into packages not exceeding 20 feet in length. Insulated base vertical antennas are preferable but grounded base type could be used if the device had enough other advantages in the way of ease of erection and ruggedness.

A method of welding high pressure piping without the aid of backing straps or with back straps which would be soluble in a harmless solution which could be introduced in the pipe before putting same into service.

A method of measuring the elastic stresses locked up in steel or other metallic structures at and beneath the surface of the material without having to dissect the structure in order to record the elastic recovery which results from isolating various segments.

A "non-slipping" shoe sole which will give good footing on an oily, steel deck of a ship rolling as much as 17°. This shoe sole should be non-injurious to feet, non-sparkling and reasonably long wearing.

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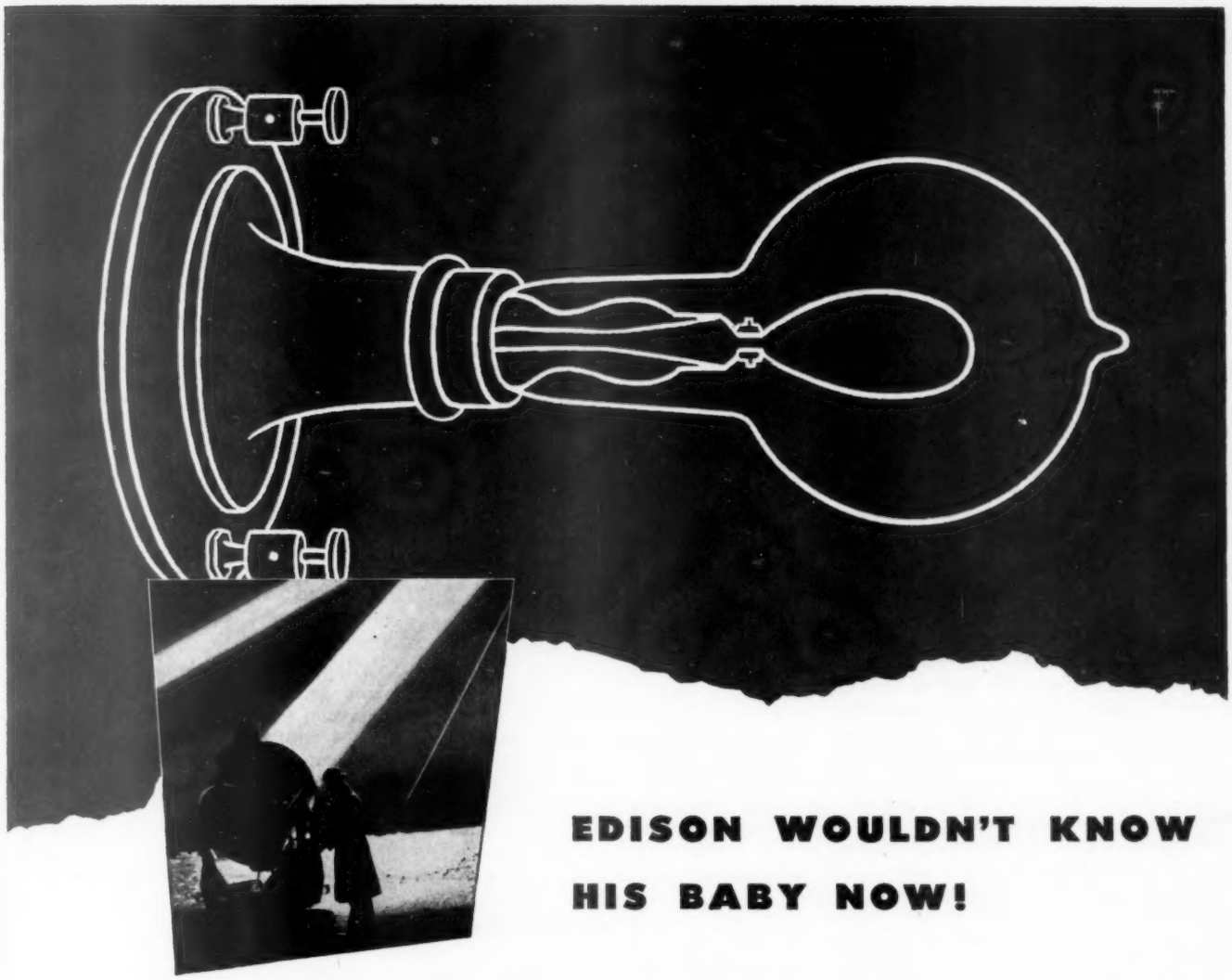

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Condensation of Ethylene with Acetylene

By N. Kozlov and P. Fedoseev

Authors' Conclusions

1. The best results in condensation of ethylene with acetylene are obtained within the temperature interval of 550-600° C.

2. Of the catalysts tested the most favorable appears to be activated carbon.

3. Nickel reduced with hydrogen at 250° and pure alumina are unsuitable as catalysts for condensation of acetylene with ethylene to form butadiene.

4. The yields of butadiene fluctuate within 0.12-0.18% on the mixture of acetylene and ethylene passed, and this low yield does not permit practical conclusions to be drawn for the time being.

CONDENSATION of ethylene with acetylene should lead to formation of butadiene:

$$CH_2 = CH_2 + CH \equiv CH \rightarrow CH_2 = CHCH = CH_2$$

Berthelot[1] was the first to indicate that butadiene is formed from acetylene and ethylene. In 1921 H. Plauson and I. A. Vielle passed an equimolecular mixture of acetylene and ethylene over catalysts at elevated pressure and temperature and obtained butadiene[2]. Condensation of acetylene with propene could be expected to give isoprene. As catalysts oxychlorides, oxides and hydroxides of alkalies and alkaline earths were recommended as well as molybdic acid. They diluted the mixture of acetylene and ethylene with inert gases, such as nitrogen and carbon dioxide, as well as with benzene.

I. G. Farbenindustrie took out patents for conversion of acetylene-ethylene mixtures[3] and acetylene-hydrogen mixtures into liquid hydrocarbons. When the mixture of acetylene and ethylene is passed through a copper-manganese tube plated with tin, butadiene is obtained in 13% yield. If, however, the tube is coated with zinc or lead, benzene is formed.

The following catalysts were suggested for this reaction: tin, silicon, lead, zinc chloride, aluminum with zinc chloride, graphite, ferric chloride and aluminum chloride.

It is to be considered, however, that formation of butadiene from mixtures of acetylene and ethylene may also involve conversion of two molecules of acetylene by the addition of hydrogen, conversion of two molecules of ethylene by the removal of hydrogen, or condensation of a molecule of acetylene with a molecule of ethylene as mentioned above. In the present study acetylene and ethylene were reacted, but it is not asserted that the net result was obtained exclusively by condensation of acetylene with ethylene. All three reactions may take place simultaneously.

Conversion of acetylene-ethylene mixtures involves formation of liquid hydrocarbons as well as the reverse process of their decomposition, including the formation of elementary carbon and hydrogen.

Experimental Part

In the experiment under report the following catalysts were used: aluminum oxide, aluminum oxide with activated carbon, anhydrous zinc chloride, nickel oxide precipitated on asbestos, metallic nickel on alumina and activated carbon. The catalyst formed a 60 cm. layer in a glass tube 1 m. long and 25 mm. diameter which was kept in an electrical furnace.

The mixture of acetylene with ethylene was passed over the catalyst at temperatures ranging from 200 to 600°C. and the products of condensation were collected in two receivers, the first of which was cooled with a mixture of snow and salt and the second with solid carbon dioxide in alcohol.

The products were brominated and distilled under 12 mm. pressure. The solid part of the bromides that did not distill was removed from the flask under cooling and after two recrystallizations from naphtha showed a melting point corresponding to that of butadiene tetrabromide (114-115°).

The aluminum oxide catalyst was prepared as follows: a solution of 250 g. aluminum sulfate in two liters water was treated with concentrated ammonia, the precipitated aluminum hydroxide was first washed by prolonged decantation for two days and was then transferred to a filter and washed with hot water

This article is the second in a series of translations from Russian scientific literature, which are being published in the TECHNICAL SECTION of National Petroleum News with the cooperation of the Petroleum Division of the American Chemical Society. The authors of the current article, which originally appeared in Sinteticheskii Kauchuk (Synthetic Rubber) in 1934 (no. 5, pgs. 36-38), are associated with the Chemical Institute of the White Russian Academy of Science.

Translation is by Dr. J. G. Tolpin of Universal Oil Products Co., Chicago. The facts and opinions presented are solely those of the original authors, and neither Universal Oil Products Co. nor the Petroleum Division of the American Chemical Society necessarily endorse the statements made.

Translates Russian Scientific Literature

J. G. TOLPIN, the translator of this series, was born in Russia and is now a citizen of the United States. He is a graduate in chemistry of the University of Kiev and a graduate of Columbia University in chemical engineering. He spent two years doing graduate work at the University of Jena, Germany.

He has been engaged in organic chemistry research, in consulting work, teaching and writing for scientific and trade journals. For the past 15 years he has continuously followed the Russian scientific literature. He is the editor of the Survey of Foreign Petroleum Literature, issued weekly by Universal Oil Products Co. This service reviews the progress of Soviet research in chemistry and oil refining.

In response to increasing requests for technical information on scientific and industrial development in Russia, Mr. Tolpin writes many articles on the subject and he is in demand for addresses before various scientific and technical audiences.

It is Mr. Tolpin's opinion that the Russian scientific literature is not well known to scientists in this country and that it is well worth while to keep abreast of it currently. Data of present value is occasionally discovered even in the old Russian literature recently brought to light and translated.

In order to familiarize American scientists and technologists with the Russian language, Mr. Tolpin designed and is teaching at Northwestern University a course in Russian. His class is attended by chemists, physicists and other scientists.

J. G. Tolpin

Mr. Tolpin is a fellow of the American Institute of Chemists, and a member of the American Chemical Society and its petroleum division, as well as of other professional societies.

to complete removal of the sulfates. Small balls were prepared from the washed aluminum hydroxide and they were dried for five hours at 110° and then heated in an electrical furnace at 300° to complete removal of the water. This catalyst possessed a high dehydration ability.

Ethylene was prepared for dehydration of ethyl alcohol over alumina by the method of Ipatieff and was then passed through wash bottles with sodium bisulfate and sodium hydroxide, with sulfuric acid and through a column of soda lime. Bromination of ethylene showed complete absence of butadiene in it.

Commercial acetylene was used and purified by passing through mercuric chloride, copper sulfate, sulfuric acid and soda lime. The purified dry ethylene and acetylene were passed to a mixer and then to the heated glass tube with the catalyst. Within three hours 100 cc. ethyl alcohol were consumed in the formation of ethylene.

Experiment 1. A mixture of equal volumes of ethylene and acetylene was passed over alumina for two hours, whereupon no condensate was obtained in the receivers at 400 and 500° reaction temperature. The reaction temperature was then raised to 600°. A small amount of condensate was obtained, containing benzene, but no butadiene.*

Experiment 2. In this experiment aluminum oxide mixed with an equal volume of French pressed activated carbon was used as a catalyst. At 400° no liquid products were obtained within two hours. At 500° a yellow liquid was obtained in the receiver cooled with carbon dioxide in alcohol. This liquid could not be removed since it instantly evaporated despite all precautions. At 550° a five hour reaction resulted in formation of 6.5 cc. liquid which was passed to a tube and the latter sealed. At 600° a three hour reaction yielded 3 cc. liquid which was also charged to a tube and the latter sealed. The uncondensed gases were passed through bromine water; the bromides were distilled under atmospheric pressure and at 115-130° 6 g. were obtained, at 130-132° 35 g., and at 132-154° 4 g. The above consisted of ethylene bromide. No butadiene bromides were formed. The liquid in the sealed tubes was treated with bromine. After distillation under a pressure of 12 mm. a solid residue was obtained which gave, upon recrystallization from alcohol, yellowish crystals melting at 109-110°. Upon further recrystallization from naphtha about 1 g. of butadiene tetrabromide was obtained with m.p. 115-116°.

Experiment 3. Using activated carbon as a catalyst an equimolecular mixture of ethylene and acetylene gave no liquid products when passed for two hours over the catalyst at 400°. At 500° a three hour reaction gave 3.5 cc. liquid and at 600° 3 cc. yellowish liquids were obtained within three hours. After the low boiling bromides were distilled off under 12 mm. pressure the solid butadiene was recrystallized once from naphtha and gave 1.5 g. of tetrabromide melting at 114-115°.*

From the distilled portion of the bromides fractionation under atmospheric pressure separated a benzene fraction with a b.p. 79-81° amounting to 2 cc. N. D. Zelinskii polymerized acetylene over activated carbon at elevated temperature and obtained a 35% yield of benzene on the total liquid condensate.

Experiment 4. Equal amounts by weight of fibrous asbestos and hydrous nickel nitrate were carefully mixed and heated in an electrical furnace. Over the so-prepared nickel oxide on asbestos catalyst, a mixture of equal volumes of acetylene and ethylene was passed at 400° which yielded after three hours 4.5 cc. liquid. By bromination and distillation of the low boiling portion of the bromides under 12 mm. pressure, about 1 g. solid product was obtained which showed a m.p. of 110-111° when recrystallized from alcohol.

Experiment 5. In this experiment metallic nickel or alumina served as a catalyst. Nickel hydroxide prepared in the usual way was mixed with aluminum oxide and reduced with hydrogen in an electrical furnace at 250°. No butadiene was formed when the mixture of acetylene with ethylene was passed over the catalyst at 300° for three hours. Further rise of the temperature caused pronounced carbon formation.

Experiment 6. Finely granulated zinc chloride converted the gaseous mixture in a two hour experiment at 200-250° into 2.5 cc. liquid. From this liquid a very slight amount of butadiene tetrabromide with m.p. 113-114° was obtained by the above described operations. With further rise of the temperature the tube became clogged (m.p. of anhydrous zinc chloride, 365°).

Editor's Note: This amounts to a yield of only about 0.18% on the mixture of ethylene and acetylene passed (about 118 g.).

Editor's Note: According to unpublished reports of N. A. Klyukvin, his tests performed in 1931-32 disclosed that the most suitable catalyst for this reaction consists of aluminum hydroxide with which yields of butadiene were obtained amounting to 1.2-2.0% on the mixture of ethylene and acetylene passed, or 3.2-5.5% on the mixture converted, (butadiene was calculated from the weight of its half solid not recrystallized tetrabromide).

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3. I. G. Farbenindustrie, *Chem. Zentr.*, 1930 I, 1049; 1930 II, 3850; C.A. 24, 1649, 1930.

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WARTIME TREND of LP-GAS INDUSTRY

(As Reflected by a Survey Covering 200 Plants Made by an Industry Committee for PAW)

By Paul K. Thompson

Chief, Liquefied Petroleum Gas Section, Natural Gas and Natural Gasoline Division, PAW

The three principal uses for liquefied petroleum gases—in refinery operations, for chemical manufacture and for synthetic rubber components—have been studied by a special industry committee for PAW. Conditions in connection with the utilization of LP-Gases as conventional fuels are recognized as abnormal and this usage discussed only briefly in the committee's report.

In chemical manufacture, the perfection of known processes may create demands for increasing quantities of ethane and propane as raw materials; while demand for butane may not be as exhaustive as has been predicted.

In refinery operations, large use of LP-Gases in the production of aviation fuel components may be expected to continue until the end of the war in the Pacific, even though total demand for finished aviation gasoline is somewhat reduced.

For synthetic rubber components, no reduction in demand for LP-Gases can be expected until total victory in Europe and the Pacific. Even then the synthetic rubber plants may be expected to continue maximum production for some time.

Return to normal times can be expected to bring a decrease in demand for LP-Gases for wartime fuels and raw materials. At the same time demand for these products as conventional fuels will increase, also for chemical manufacture. An expanding LP-Gas industry in postwar years appears assured.

THE CONTINUED use of liquefied petroleum gas as a fuel and a source of energy, together with its more recent application as a raw material in the production of aviation fuel, synthetic rubber and chemicals, has placed this product foremost in the class of critical materials. Possibly the use of no other petroleum product has developed so rapidly as the separate fractions and mixtures of propane and butanes.

The greatly accelerated war use of LP-Gas was definitely confirmed during the winter months of 1943-44 when transportation difficulties, together with localized shortages, brought about by necessary diversion of products as war materials, precipitated the worst winter in the history of the LP-Gas industry.

Early in the spring of 1944, it appeared that a similar condition would be encountered during the winter of 1944-45. Thus, to make available all possible information relating to the supply and demand of LP-Gas, the Petroleum Administration for War requested industry representatives to determine as nearly as possible these conditions in PAW Dist. I, II, III and IV for 1943, 1944 and the first 6 months of 1945. Similar information was already available for Dist. V, embracing California, Arizona, Nevada, Oregon and Washington.

This paper will discuss the service performed by the Special LP-Gas Survey Joint Subcommittee in preparing this report, making available for publication such portions of this study as wartime security permits in addition to commenting on related factors such as government regulations, distribution, etc., endeavoring to analyze these factors in the light of what may be expected in the immediate future, together with the developments which may result with the return to normal times.

James E. Pew, Director of the PAW Natural Gas and Natural Gasoline Division, called a joint meeting of the LP-Gas Subcommittees of PAW Dist. I, II, III and IV, which resulted in the organization of a Special LP-Gas Survey Joint Subcommittee. (See Table I.)

Studies Supply and Demand

This committee was requested by the PAW to ascertain as nearly as possible the relation between the supply and demand of liquefied petroleum gases for 1943, 1944 and the first six months of 1945 in the U. S., excluding the West Coast (Dist. V). In carrying out this request, a questionnaire was prepared by the committee for the purpose of securing information on both the production and disposition of liquefied petroleum gases.

To ascertain the actual and estimated potential production for the period in question, a form was developed which when properly filled out gave the requested information for (1) propane[1], (2) normal butane, (3) isobutane, (4) butane-propane mixtures, and (5) normal butane-isobutane-butylene mixtures. In determining the disposition of products, a separate form for each of the above products was developed to indicate that amount for (1) fuel purposes[1], (2) chemical manufacture, (3) refinery use, (4) isomerization feed, (5) synthetic rubber components, and (6) potential excess production.

Information was received from 189 separate companies—six companies did not reply in any way to the questionnaire or the follow-up communications. The information supplied by 110 companies, representing 201 different plants, was summarized and reported graphically by the committee. In addition, comments and recommendations are contained in the committee's report to PAW.

The release of the complete report at this time, in which statistics for the last nine months of 1944 are estimated, may appear to some as coming at too late a date to be of maximum value. However, and to the contrary, PAW was continuously advised by the committee throughout the progress of the survey, and since the major portion of the work was completed during the summer months, the resulting information has been of invaluable help in planning for the present winter. It is quite impossible to enumerate here the difficulties encountered by the committee in conducting this study, these difficulties being directly responsible for the apparent delay in its final presentation.

The LP-Gas survey covered only the production and disposition of products. Naturally, related problems such as transportation, manpower and lack of equipment contribute to the success or failure of wartime distribution even though the required products are available in the field or refinery. It was decided to limit this study, as previously noted, and rely upon information presently available to industry concerning distribution. Shortly after this study was under way, it was evident that such a decision was correct because it was necessary for the committee to exert all its energy to conduct and complete this work even at a late date. The many problems encountered by the committee did not affect the quality of their final report. The successful manner in which these problems were solved is partly reflected in their splendid report, a portion of which is discussed herein.

In analyzing the relationship of supply and disposition of LP-Gas, widely different local conditions become apparent. Although such conditions contribute to the over-all picture, any single condition

[1]Refer to glossary for definition of products and other notes.

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is not necessarily representative of the entire situation as reflected by such a survey. Too, ever-changing problems of transportation and storage added to the many other variables together make the present LP-Gas fuel situation a problem of most difficult proportions.

These variables dictate that the release of information relating to the total production and use of LP-Gas as fuel, would tend to distort the picture and result in false conclusions rather than to provide a basis for industry to solve its present problems. Accordingly, the use of LP-Gas as fuel is only commented on herein while its use as a chemical raw material, for refinery operations, and for synthetic rubber components is discussed graphically with actual and estimated yearly figures presented.

Use in Chemical Industry Grows

The growing trend of LP-Gas as a chemical raw material is shown in Chart I. The major components, presently employed for chemical use, are propane and butane-butylene mixtures. This study indicates that a total of 110,895,000 gal. of LP-Gas, as a liquid, was used as a chemical raw material in 1943. The 1944 requirement is set at 159,788,000 gal., an increase of 44%. It should be noted that these amounts are for that LP-Gas shipped as a liquid only. Larger amounts of these gases are delivered to chemical plants in the gaseous form by pipelines.

A recent estimate[2] of the quantity of LP-Gas used as a chemical raw material delivered as liquid or gas in the U. S. indicates that a total of 389,127,500 gal. equivalent was used in 1943. The 1944 requirement, with the latter nine months estimated, was set at a 478,022,000 gal. equivalent, an increase of 23%. This chemical use of LP-Gas continues to grow with prediction of ever increasing amounts of ethane-propane and propane-butane mixtures as raw material in processes employing regenerative cracking and catalytic oxidation, respectively.

[2] "Science in Natural Gas" by James E. Pew and Frank H. Dotterweich, Petroleum Administration for War; NPN Technical Section, Jan. 3, 1945, p. R-11.

In the production of newer, better and greater quantities of aviation fuel and to continue to meet essential military and civilian requirements of various fuels and other petroleum products, large quantities of LP-Gas are being used in refinery operations. In reporting the growing trend of LP-Gas for refinery uses (Chart II) security restrictions have necessitated that this classification include not only conventional refining demands but those for isobutane for alkylation and butane for isomerization purposes.

Paul K. Thompson

This is necessary to eliminate any possible prediction relating to increased alkylate production.

Nevertheless, the increased use of LP-Gases for total refinery uses reflects their growing importance in the production of aviation fuel components. In 1943, 1,558,209,000 gals. of LP-Gas were used for refinery operations and 2,327,208,000 gals. estimated in 1944. This increase of 768,999,000 gals. (about 50%) is of interest when compared with the total sales of LP-Gases in the U. S. for 1943 of 675,233,000 gals. as reported by the U. S. Bureau of Mines.[3]

This large use of LP-Gas in refinery operations can be expected until total victory. The termination of the war in Europe should not bring any reduction in the manufacture of key aviation fuel components such as isooctane alkylate, even though the total production of finished aviation fuel may be temporarily reduced until the concentration of the total war effort is established in the Pacific Area.

Another burden placed upon butanes is their wartime role in the production of synthetic rubber. In achieving the required production of synthetic rubber, which has been recognized by many as the outstanding chemical achievement of the war, enormous quantities of light hydrocarbon gases are required as raw material. The contribution of LP-Gas products is graphically portrayed in Chart III. In the production of butadiene, one of the chief ingredients of synthetic rubber, large quantities of butane-butene mixtures are required. Thus, as in the case of isooctane alkylate, the production of synthetic rubber imposes large demands upon butanes. The survey reveals that 55,434,000 gals. of LP-Gas were required for synthetic rubber production in 1943 and 205,457,000 estimated in 1944, an increase of 270%.

Again, the future demands for LP-Gas products for synthetic rubber components are similar to those previously mentioned in the production of aviation fuel in that no reduction in their use can be expected until total victory in Europe and the Pacific. Even with total victory, the nation's synthetic rubber plants may be expected to continue maximum production to fill backlogs of civilian requirements in addition to replacing large amounts of imported natural rubber until such time as natural rubber sources are once more revived and productive.

More Propane Used as Fuel

As mentioned above, statistical and graphical data will not be given for LP-Gas fuel uses. However, it is interesting to note that the survey clearly indicated a swing of significant magnitude to the predominance of propane over butane-propane mixtures for fuel uses. This abnormal relationship results, of course, from the temporary diversion of large quantities of butanes to war products. The fuel use of normal butane and spent refinery butanes throughout the period studied, continues to bear the same relationship to the use of propane and butane-propane mixtures, as in the past.

The use of propane as fuel appears to have experienced the greatest increase of all LP-Gas fuels, mainly because of the diversion of butanes. Accompanying this increase are the conventional moderate seasonal fluctuations. The wide-

[3] Mineral Market Report No. MMS 1204, U. S. Bureau of Mines, July 15, 1944.

TABLE 1—Organization of Special LP-Gas Survey Joint Sub-Committee

Chairman, G. R. Benz, Phillips Petroleum Co., Bartlesville, Okla.; chairman Dist. II LP-Gas Sub-Committee, Natural Gas and Natural Gasoline Committee.

Louis Abramson, Petrolane Gas Corp., New Orleans; chairman Dist. III LP-Gas Sub-Committee, Natural Gas and Natural Gasoline Committee.

R. W. Leslie, Wasatch Oil Refining Co., Salt Lake City; chairman, Dist. IV LP-Gas Sub-Committee, Natural Gas and Natural Gasoline Committee.

W. A. Naumer, Carbide & Carbon Chemicals Corp., New York; chairman Dist. I LP-Gas Sub-Committee, Natural Gas and Natural Gasoline Committee.

Secretary, E. M. Petersen, Northern Natural Gas Co., Omaha; secretary Dist. II Natural Gas and Natural Gasoline Committee.

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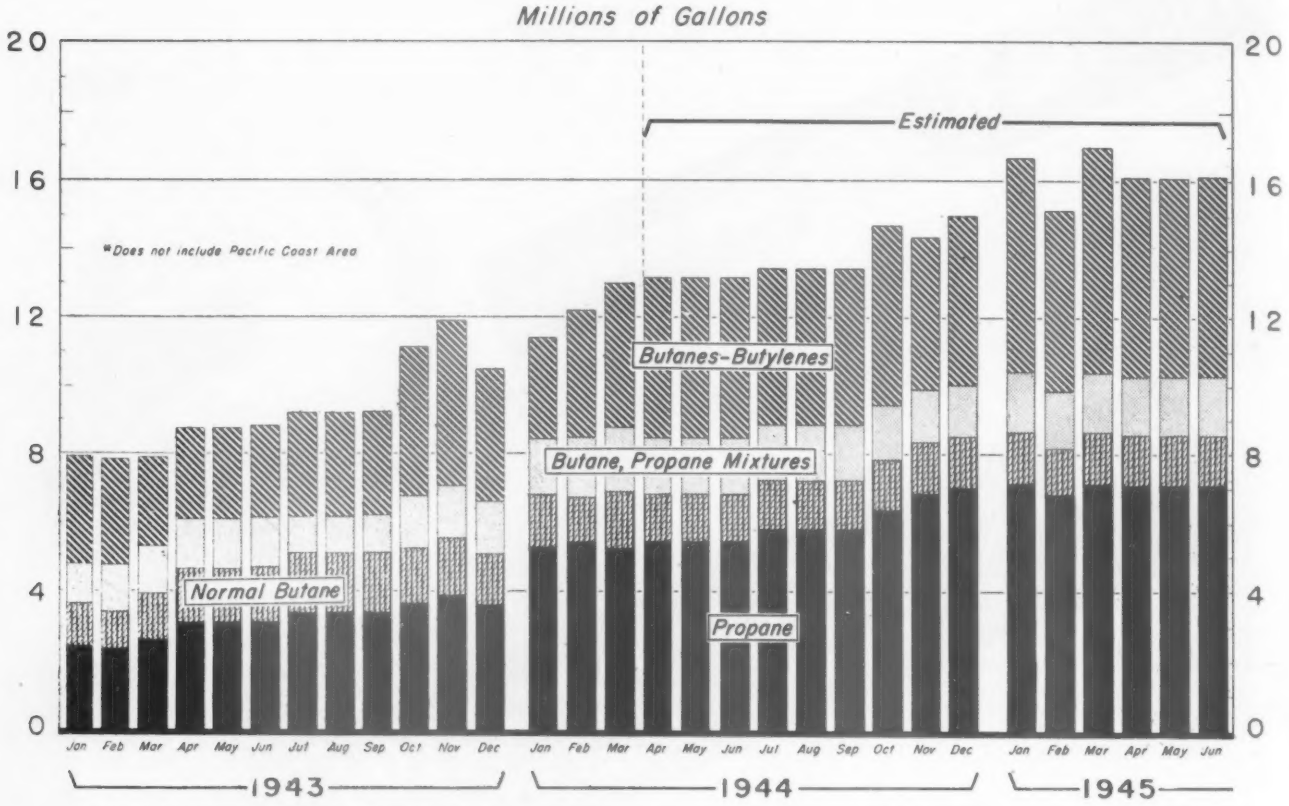

Chart 1—Use of liquefied petroleum gases for chemical manufacture. (Pacific Coast area not included)

spread use of butane-propane mixtures as heating fuels results in more pronounced seasonal demands than are evident in the use of any other LP-Gas product. The moderate increase in the use of LP-Gas products for fuel, other than butane-propane mixtures and the slight increase in the use of the latter, clearly reflect the results of the necessary steps taken by government and industry to insure the availability of these components for use in the production of vital war materials.

The well known fact that ample propane exists at production sources was indicated by the survey. As previously pointed out, the survey did not report factually on the very serious distribution phases. The lack of distribution facilities precludes the classification of this potential supply as available supply for actual consumer demands.

The critical butane and butane-propane situation of the past winter, together with that of the present winter, is definitely confirmed by the survey. It should be noted that the survey indicates a greater shortage of butane and butane-propane mixtures for the winter period of 1944-45 than was experienced during the winter of 1943-44. The severity of the current shortages, as of December, 1944-January, 1945, of LP-Gas for fuel, is the direct result of lack of transportation facilities, mentioned above, and also of the lack of butane, which was clearly predicted by the survey as early as the summer of 1944.

Although the entire report cannot be released at this time for war security reasons, it is hoped that industry will recognize the effort of the commitee and the value of the report submitted. The interest of industry in such surveys is timely, and it would seem to be appropriate for a continuation of these studies by industry on the return to normal times when war agency requests for such work will not be forthcoming. In anticipation of

Glossary

Propane—LP-Gas products containing 90% or more propane and/or propylene.

Normal Butane—LP-Gas products containing 90% or more normal butane.

Isobutane—LP-Gas products containing 90% or more isobutane.

Butane-Propane Mixtures—LP-Gas products containing more than 10% propane and/or propylene.

Normal Butane-Isobutane-Butylene Mixtures—LP-Gas products not included in the above classifications.

Fuel Purposes—Fuel purposes include the following: Continuous and standby uses for domestic, commercial, industrial, agricultural, and utility applications including but not limited to the following: cooking, water heating, refrigerating, space heating, metal cutting, all kinds of industrial heating applications, gas manufacture, internal combustion engine fuel, drying, baking, etc.

Chemical Manufacture—Chemical manufacture includes products used as base materials or process feed stocks, additives, diluents, extenders, solvents for chemical manufacture or processing (except specific uses otherwise classified below), and for burning to make carbon black.

Refinery Use—Includes all refinery use except that for isomerization feed stock. Includes LP-Gas used for refinery fuel and blending purposes.

Isomerization Feed—Includes all isomerization feed stock uses.

Synthetic Rubber Components—Includes all products to be used for processing into or manufacture of synthetic rubber components.

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present LP-Gas problems continuing throughout the year of 1945 the PAW has requested the Special LP-Gas Survey Joint Sub-Committee to continue to study for an additional period of time. It is contemplated to expand the proposed study to include PAW District V (West Coast) thus making the survey nationwide in scope.

For over three years the operations of industry have been controlled and restricted by wartime regulations. The basic restrictions affecting the LP-Gas distribution industry are those embodied in WPB Limitation Order L-86 and Directions thereto. Broadly, Order L-86 prohibits the delivery and installation of equipment used to contain, distribute, or dispense LP-Gases. Direction 1 to Order L-86 restricts the delivery and acceptance of delivery of LP-Gas tanks. Direction 2 to Order L-86 prohibits the delivery and acceptance of delivery of LP-Gases for use as a motor fuel in private passenger automobiles.

Conservation Was Original Purpose

The original purpose of Order L-86, when it was first issued April 8, 1942, was twofold: first, to conserve the then existing utilization equipment for the most important war uses; and, second, to conserve LP-Gas itself so that war demands could be met, and also, insofar as possible, so that the requirements of existing LP-Gas consumers could be satisfied.

As the demand for LP-Gas for use in the production of war materials increased, the primary function of Order L-86 became the conservation of LP-Gas, with the importance of equipment conservation becoming secondary but still quite necessary.

The administration of these regulations has attempted to accomplish the above purposes with a minimum of restrictions upon the industry. However, as the aviation gasoline and synthetic rubber programs progressed, with the resulting tremendous requirements for LP-Gas products, it became necessary to impose more restrictive measures. With the tentative report of the committee available in September, 1944, it was immediately evident that additional restrictions were necessary to meet the forthcoming conditions as predicted by the survey.

Thus, on Oct. 24, 1944, the PAW announced the issuance of PAW Directive 79. This directive prohibits the delivery or acceptance of delivery of butane for use as fuel in drilling operations where natural gas is available as a substitute fuel. This directive is effective during the present heating season Nov. 1, 1944, to April 1, 1945. During this time the quantity of butane that will be available for drilling operations will be limited because of the demand for this fuel by domestic consumers during the winter months.

Further, PAW announced, by press release Nov. 24, 1944, that as of that date PAW would be compelled to disapprove all applications to install equipment utilizing butane or butane-propane mixtures.

As indicated by the preliminary report of the committee and substantiated by their final report, there was a shortage amounting to 4 to 7,000,000 gals. per month of butane for all uses. This shortage was immediately felt by the LP-Gas industry. With the co-operation of the Refining Division of PAW, the necessary steps to alleviate this condition were taken to divert certain streams of mixed butanes from refinery use to LP-Gas fuel markets.

Postwar Expansion Expected

The present shortage of LP-Gas products, the result of wartime demands, is a widely discussed subject. These discussions are not, in general restricted to present conditions but in many cases predictions have been voiced that these shortages will continue even after the return to normal times. Some visualize a propane shortage; others predict continued difficulty in obtaining the desired amounts of butane. The discussion herein relating to LP-Gas operations, on the return to normal times, is based upon an analysis of the Survey Committee's report, viewed in light of related information gathered in this Division.

The trend observed suggested that, with the return to normal times, there will be a marked decrease in the demand for LP-Gas products which are now required for wartime fuels and raw materials. Accompanying that decrease will be an increase in use as conventional LP-Gas fuel, including the possible development and production of new fuels and for chemical manufacture. Thus,

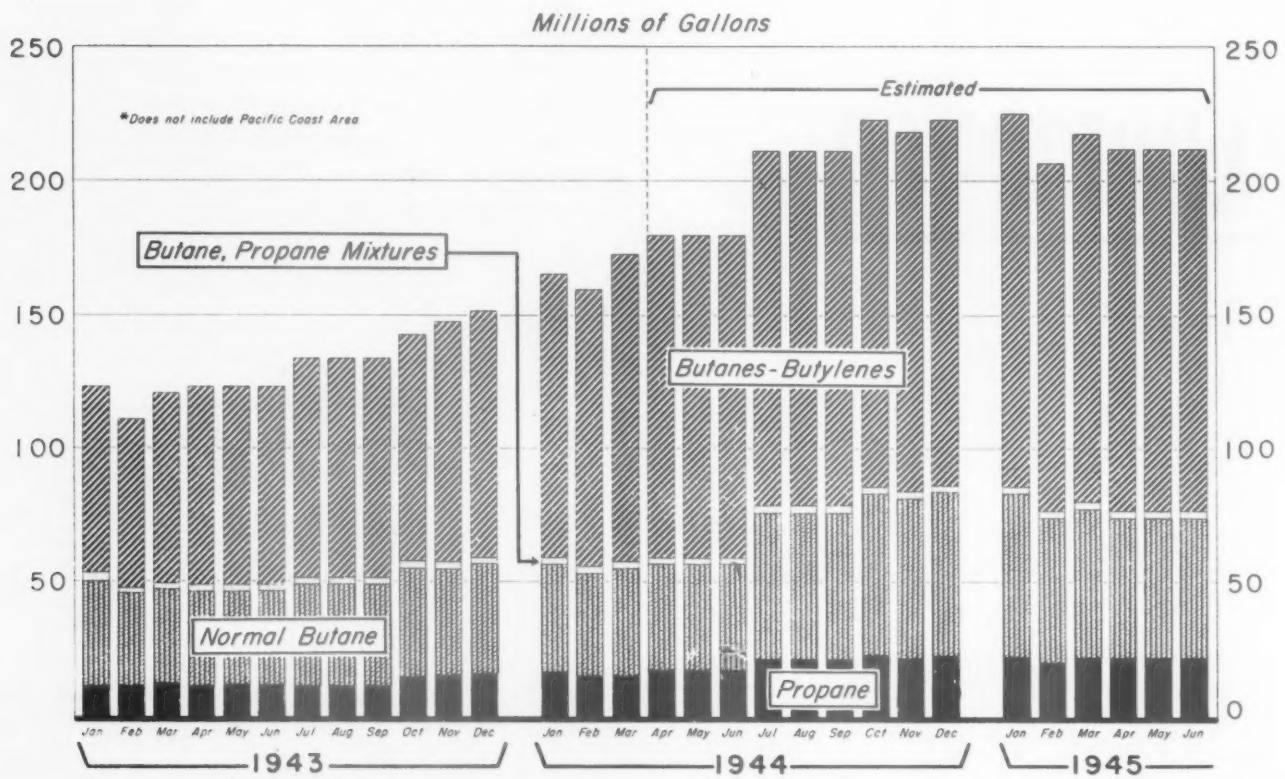
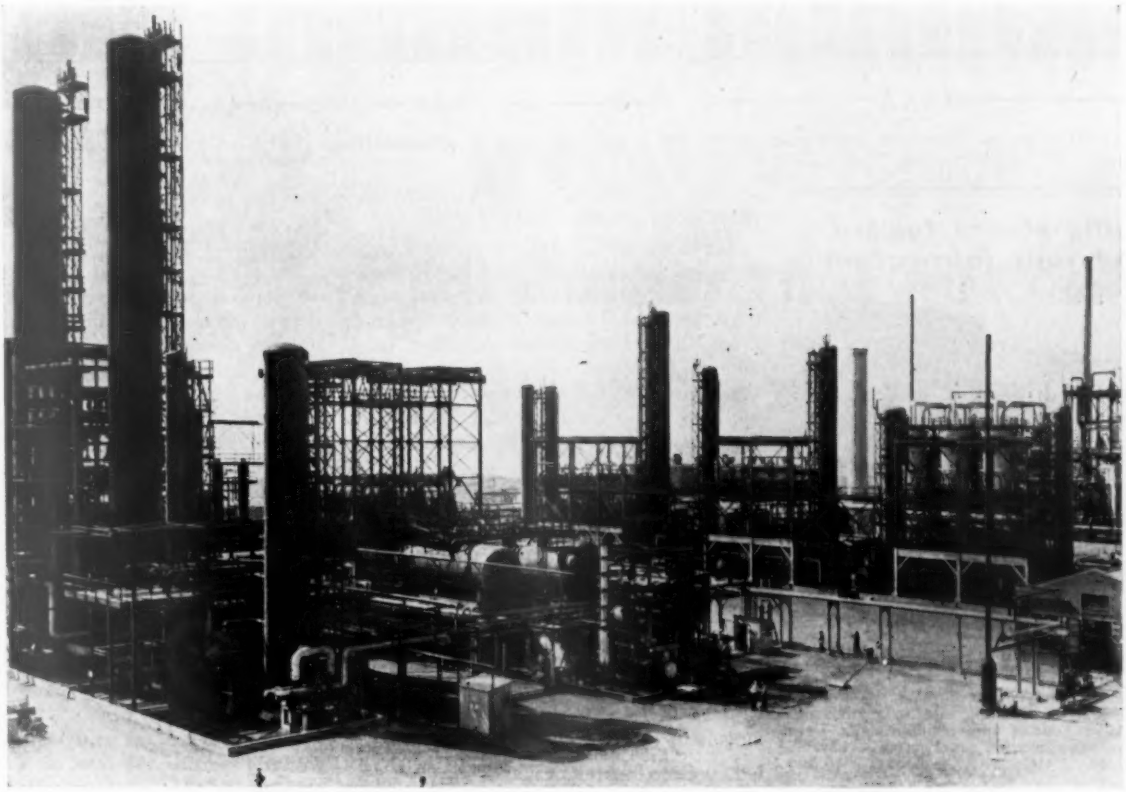


Chart II—Refinery uses of liquefied petroleum gases. (Pacific Coast area not included)

PRESSURE VESSELS
FOR
OIL REFINERIES
AND
CHEMICAL PLANTS



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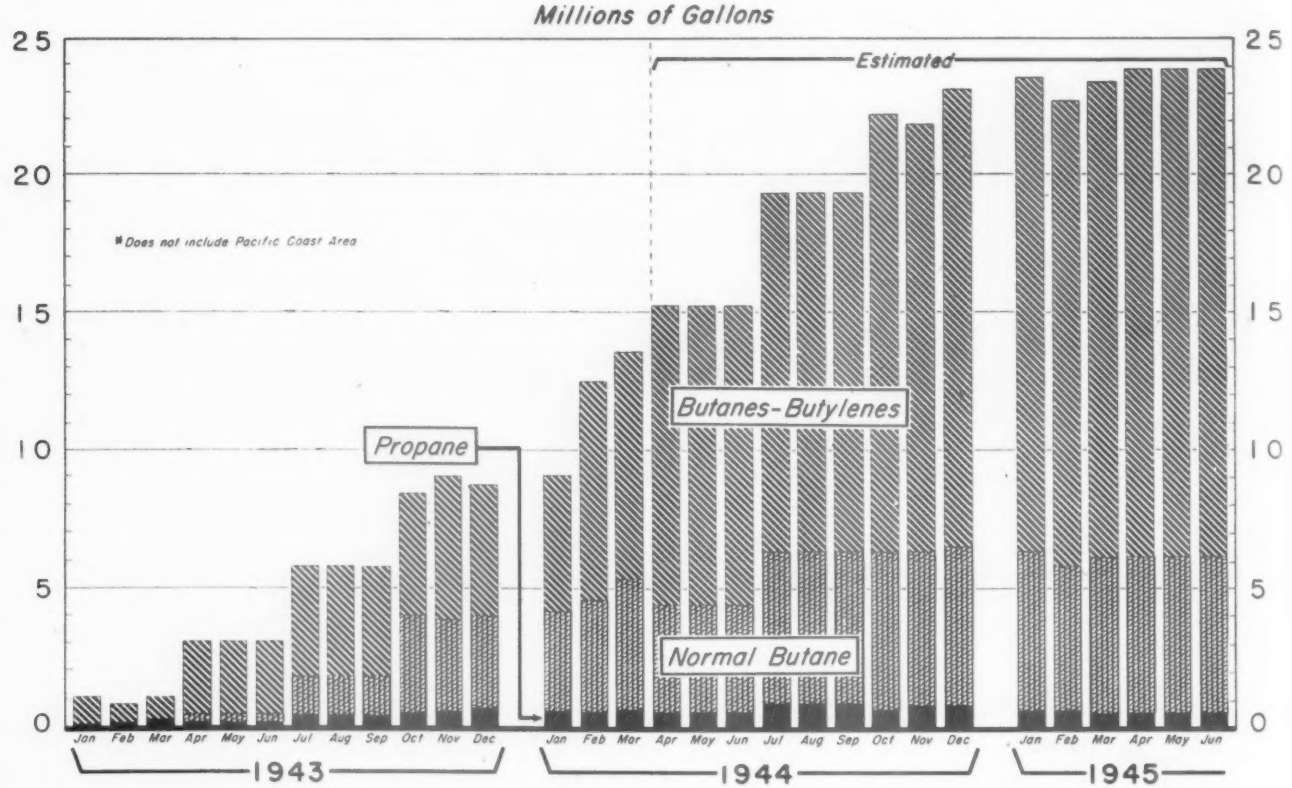
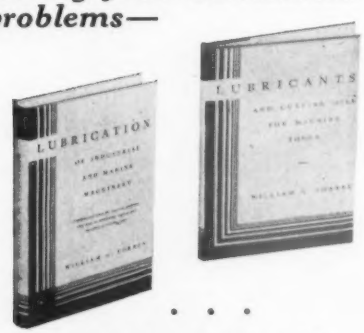


Chart III—Use of liquefied petroleum gases for synthetic rubber components. (Pacific Coast area not included)

Stepping stones toward solving your lubrication problems—



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an ever expanding LP-Gas industry appears to be assured.

There should be ample supplies of propane and butanes to be used as economic conditions dictate, with increased supplies as needed, made possible by the availability of equipment for their production, transportation, storage and utilization. As increased demands for LP-Gas products come about, production should keep pace with or possibly exceed market demands.

Increased discoveries of natural gas and gas-condensate fields and the development of "cat"-cracking operations, together with modern extraction and separation procedures, apparently assures the availability of increasing amounts of light hydrocarbon fractions for LP-Gas products. In addition, these developments suggest production of sizable amounts of LP-Gas in locations where heretofore a long haul by tank car was necessary.

Diversified opinions have been voiced regarding the magnitude of demands which may be made of LP-Gas in its capacity as a chemical raw material on the return to normal times. Based upon present operations, which find butane-butene and isobutane as the key components for present chemical manufacture, when synthetic rubber and aviation fuel are included, there is a tendency to predict that butanes will be in such demand that a general shift to the lighter product propane will be necessary for the expansion of the LP-Gas fuel industry. Rapidly changing conditions suggest that this supposition may not be entirely correct. In fact, some predict just the opposite; i.e., propane will be the key component for chemical manufacture and not butane.

In analyzing this situation[4], it must be pointed out that with the return to normal times the large quantities of butanes presently going into war material can be made available for peacetime uses. Too, we are now passing from an era of moderate thermal cracking into one in which intensified catalytic operations will predominate. Thus, where butane has been necessary to produce propylene in moderate thermal cracking, catalytic dehydrogenation will permit the use of propane as charging stock when the perfection of a satisfactory separation process is developed.

In general, the present trend suggests that acetylene, ethylene and propylene will be the major components in tomorrow's chemical synthesis. The perfection of processes presently under investigation indicates the use of ethane and propane in ever increasing quantities as raw materials for the production of these chemical components. Naturally, butane will be required as a raw material in many chemical operations, but this demand may not be as exhaustive as predicted by some. Therefore, the return to normal times should be a balanced demand for LP-Gas products, allowing this industry to expand and progress in a reasonably stable and desirable fashion.

In a paper[5] presented before an in-

(4) It is estimated that in 1944, LP-Gas used as fuel will be less than 20% of the total LP-Gas used for all purposes.

dustry association meeting in New Orleans, September, 1944, the author cautioned against the difficulties presently experienced by the warning, " . . . In other words, your immediate program should be to prepare for the worst." This advice still holds true and even after the present heating season is past the LP-Gas industry must continue a program which will enable it to meet its wartime responsibilities.

The difficulties now being encountered by the LP-Gas industry to meet its responsibilities may even become more acute. Nevertheless, these sacrifices and determined efforts of industry will not go unrewarded because these very experiences are creating an orderly, matured industry insuring a firm foundation upon which will be built tomorrow's modern LP-Gas industry, an industry fully exploiting its unlimited opportunities and whose stature in a relatively short period of time will compare favorably with that of other large industries.

(5) "Will We Weather the Winter" by Paul K. Thompson, Petroleum Administration for War.

TECHNICAL MEETINGS FOR OIL MEN

In response to recent government requests, many technical societies have cancelled or postponed their usual annual and semi-annual meetings. To the extent that we have the information available, the listings below give the meetings which had already been scheduled and their present status.

MARCH

12-14, National Association of Corrosion Engineers, President Hotel, Kansas City, Mo.

APRIL

1-3, Amer. Institute of Chemical Engineers, Houston. (**Postponed** until fall.)

4-6, Amer. Gas Association, Technical Section Conferences, Hotel Stevens, Chicago. (**Cancelled**)

11-13, Natural Gasoline Association of America, 24th Annual Convention, Baker Hotel, Dallas. (**Postponed**)

16-18, Amer. Society of Mechanical Engineers, Spring Meeting, Boston. (**Postponed** indefinitely)

MAY

9-11, Amer. Oil Chemists Society, New Orleans, La. (**Cancelled**)

11-12, Amer. Institute of Chemists, Deshler-Wallick Hotel, Columbus, Ohio.

16-17, Society of Automotive Engineers, Diesel Fuel and Lubricants Meeting, Hotel Carter, Cleveland. (Request for permission to hold this and other SAE meetings now pending.)

21-23, Amer. Gear Manufacturers Association, The Homestead, Hot Springs, Va. (**Cancelled**)

JUNE

18-21, Amer. Society of Mechanical Engineers, Semi-Annual Meeting, Chicago. (**Postponed**)

In addition to the above, the following groups have cancelled or postponed their usual meetings, which had not yet been definitely scheduled:

American Association for the Advancement of Science.

American Chemical Society, Annual Spring Meeting.

National Petroleum Association, all Technical Meetings.

Western Petroleum Refiners Association.

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Preventing Explosive Atmospheres By Dilution with Inert Gases

FOR the past several years it has been common practice to dilute explosive atmospheres with inert gases and thereby reduce the effective oxygen concentration to a point where the complex mixtures thus formed become non-inflammable. The problem thus develops of determining the amount of inert gas required to render the combustible-air mixture non-inflammable.

As part of its work in promoting safety, the United States Bureau of Mines is investigating various means of eliminating or mitigating the explosion hazards with combustible gases encountered in mining and industry. The most recent report on this work is Report of Investigations 3787, "Prevention of Benzene-Air Explosions by Addition of Nitrogen and Carbon Dioxide," by G. W. Jones, senior chemist, explosives division, Central Experiment Station, Pittsburgh.

This report gives essential data required for the calculation of explosive limits of complex combustible gaseous mixtures containing varying percentages of benzene. Benzene vapor is a normal constituent of a wide variety of manufactured gases. It also is extensively used in the solvent industry and in the manufacture of high explosives.

Data have been obtained and graphs and tables prepared showing the inflammable areas of all possible mixtures of benzene vapor, air and added carbon dioxide or nitrogen. By means of these graphs and tables the limits of inflammability of complex gaseous mixtures containing benzene may be calculated, and the percentages of oxygen in the mixtures that must not be exceeded to prevent the mixtures from becoming inflammable may be determined.

This information is of particular importance in safety work because by its application combustible mixtures containing benzene can be removed safely from containers of various sorts and equipment; or the mixtures may be introduced into such equipment originally containing air without creating inflammable atmospheres, if the proper volumes of inert gases—nitrogen or carbon dioxide, or mixtures of the two—are present in the proper concentrations when the benzene is introduced.

General Principles

Although specifically limited to explosive mixtures of vapors containing benzene, the basic principles discussed in this report may be applied to other explosive mixtures. To this end, data are given showing the lower explosive limits of many commonly-used hydrocarbon gases when nitrogen or carbon dioxide are added as diluents, as well as the concentration of oxygen in such mixtures below which no mixture is inflammable (Table 1).

In securing the data presented in this report, mixtures of air and benzene were bottom-ignited in a long vertical tube until mixtures were attained that just barely would inflame through the entire mixture. The limits reported are averages of compositions that just propagated flame through the tube and those that just failed to do so.

Limits of inflammability (considered as identical with explosive limits) of benzene in air were determined to be 1.40% and 7.10%. Tests then were made on mixtures within these limits, to which were added varying amounts of nitrogen or carbon dioxide.

In this latter determination, combus-

TABLE 1—Extinction of Flames by Adding Nitrogen and Carbon Dioxide

Combustible	Limits of inflammability, percent by volume		Volumes of inert gases required to render 1 volume of hydrocarbon gas noninflammable under all conditions —of dilution with air—			Oxygen % by volume, below which no mixture inflammable	
	Lower	Higher	N_2	CO_2	Ratio CO_2:N_2	N_2 added	CO_2 added
Methane	5.00	15.0	6.0	3.3	0.55	12.1	14.6
Ethane	3.10	12.5	12.8	7.3	.57	11.0	13.4
Propane	2.37	9.5	14.9	7.9	.53	11.4	14.3
Butane	1.85	8.4	17.2	9.3	.54	12.1	14.5
Pentane	1.45	7.8	22.3	12.2	.55	12.1	14.4
Hexane	1.25	6.9	25.0	14.0	.56	11.9	14.5
Butadiene	2.00	11.5	19.6	12.0	.61	10.4	13.1
Ethylene	2.75	28.6	15.3	9.0	.59	10.0	11.7
Propylene	2.40	10.3	14.0	7.7	.55	11.5	14.1
Cyclopropane	2.45	10.4	13.5	8.0	.59	11.7	13.9
Benzene	1.40	7.1	21.2	12.9	.61	11.2	13.9
Hydrogen	4.00	74.2	16.5	10.2	.62	5.0	5.9
Carbon monoxide	12.50	74.2	4.1	2.2	.54	5.6	5.9
Average	...	...	...	...	.57	...	...

TABLE 2—Limit Mixtures of Benzene, Air, and Added Nitrogen

Composition of limit mixture —percent by volume—			O_2 in mixture, percent by volume	Added N_2 + C_6H_6, percent by volume	Ratio Added N_2: C_6H_6
Added N_2	C_6H_6	Air			
0.00	1.40	98.60	20.60	1.40	0.0
6.00	1.40	92.60	19.40	7.40	4.3
10.70	1.40	87.90	18.40	12.10	7.6
19.35	1.45	79.20	16.60	20.80	13.3
22.75	1.50	75.75	15.85	24.25	15.2
31.70	1.75	66.55	13.95	33.45	18.1
34.90	1.80	63.30	13.25	36.70	19.4
38.00	1.85	60.15	12.60	39.85	20.5
41.30	1.95	56.75	11.90	43.25	21.2
43.45	2.05	54.50	11.40	45.50	21.2
43.75	2.15	54.10	11.30	45.90	20.3
44.25	2.30	53.45	11.20	46.55	19.2
44.20	2.45	53.35	11.15	46.65	18.0
42.60	2.80	54.60	11.45	45.40	15.2
37.15	3.85	59.00	12.35	41.00	9.6
33.00	4.25	62.75	13.15	37.25	7.8
30.55	4.55	64.90	13.60	35.10	6.7
28.45	4.85	66.70	13.95	33.30	5.9
24.45	5.30	70.25	14.70	29.75	4.6
17.75	5.90	76.35	16.00	23.65	3.0
15.80	6.10	78.10	16.35	21.90	2.6
6.50	6.55	86.95	18.20	13.05	1.0
.00	7.10	92.90	19.45	7.10	.0

TABLE 3—Limit Mixtures of Benzene, Air, and Carbon Dioxide

Composition of limit mixture, per cent by volume			O_2 in mixture per cent by volume	CO_2 + C_6H_6, per cent by volume	Ratio CO_2: C_6H_6
CO_2	C_6H_6	Air			
0.00	1.40	98.60	20.60	1.40	0.0
12.40	1.75	85.85	17.95	14.15	7.1
22.00	1.90	76.10	15.95	23.90	11.6
25.00	2.05	72.95	15.25	27.05	12.2
27.05	2.10	70.85	14.85	29.15	12.9
30.40	2.35	67.25	14.10	32.75	12.9
30.85	2.75	66.40	13.90	33.60	11.2
30.60	2.90	66.50	13.90	33.50	10.6
30.55	3.10	66.35	13.90	33.65	9.9
30.35	3.35	66.30	13.90	33.70	9.1
29.85	3.70	66.45	13.90	33.55	8.1
27.05	4.15	68.80	14.40	31.20	6.5
25.40	4.30	70.30	14.70	29.70	5.9
23.20	4.70	72.10	15.10	27.90	4.9
20.40	5.00	74.60	15.60	25.40	4.1
18.45	5.25	76.30	15.95	23.70	3.5
16.40	5.50	78.10	16.35	21.90	3.0
14.50	5.70	79.80	16.70	20.20	2.5
10.75	6.10	83.15	17.40	16.85	1.8
.00	7.10	92.90	19.45	7.10	.0

tibles other than benzene also were considered, such as the paraffins through hexane, ethylene, propylene, cyclopropane, hydrogen and carbon monoxide (Table 1). The ratio of carbon dioxide to added nitrogen was found to range from 0.53 to 0.62 (average 0.57), giving rise to the conclusion that the extinctive effect of the two gases is due largely to their relative heat capacity (N_2, 7.46; CO_2, 11.85; 7.46/11.85 = 0.63).

Explosive Limit Mixture

Table 2 shows the limit mixtures of benzene, air and added nitrogen. Concentrations of nitrogen finally became so high that the mixtures became noninflammable when mixed with air in any pro-

TABLE 4—Inflammability Limits of Hydrogen-Nitrogen and Hydrogen-Carbon Dioxide Mixtures

Vol. N_2	Limits of inflammability per cent by volume	
Vol. H_2	Lower	Upper
0.0	4.0	74.0
0.5	6.0	74.0
1.0	8.5	74.0
1.5	10.5	75.0
2.0	12.5	75.0
2.5	15.0	75.5
3.0	17.0	75.5
3.5	19.0	75.5
4.0	21.0	75.5
4.5	23.5	75.5
5.0	25.5	76.0
5.5	28.0	76.0
6.0	30.0	76.0
6.5	32.5	76.0
7.0	34.5	76.0
7.5	37.0	76.0
8.0	39.5	76.0
8.5	41.5	76.0
9.0	44.0	76.0
9.5	46.0	76.0
10.0	48.0	76.0
10.5	50.0	76.0
11.0	52.5	76.0
11.5	54.5	76.0
12.0	56.5	76.0
12.5	58.5	76.0
13.0	60.5	76.0
13.5	63.0	75.5
14.0	65.0	75.5
14.5	67.0	75.5
15.0	69.0	75.5
15.5	71.0	75.5
16.0	73.5	75.5
16.5	75.5	75.5
16.6	Noninflammable	

Vol. CO_2	Limits of inflammability per cent by volume	
Vol. H_2	Lower	Upper
0.0	4.0	74.0
0.5	6.0	72.0
1.0	8.5	69.0
1.5	10.5	67.5
2.0	12.5	67.0
2.5	15.0	66.0
3.0	17.0	65.5
3.5	19.0	65.5
4.0	21.0	65.0
4.5	23.5	64.5
5.0	26.5	64.5
5.5	30.0	64.5
6.0	33.0	64.0
6.5	36.0	64.0
7.0	39.5	63.5
7.5	43.0	63.5
8.0	46.0	63.0
8.5	49.5	63.0
9.0	52.5	63.0
9.5	55.5	62.0
10.0	58.0	60.0
10.2	59.5	59.5
10.3	Noninflammable	

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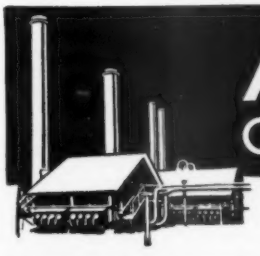

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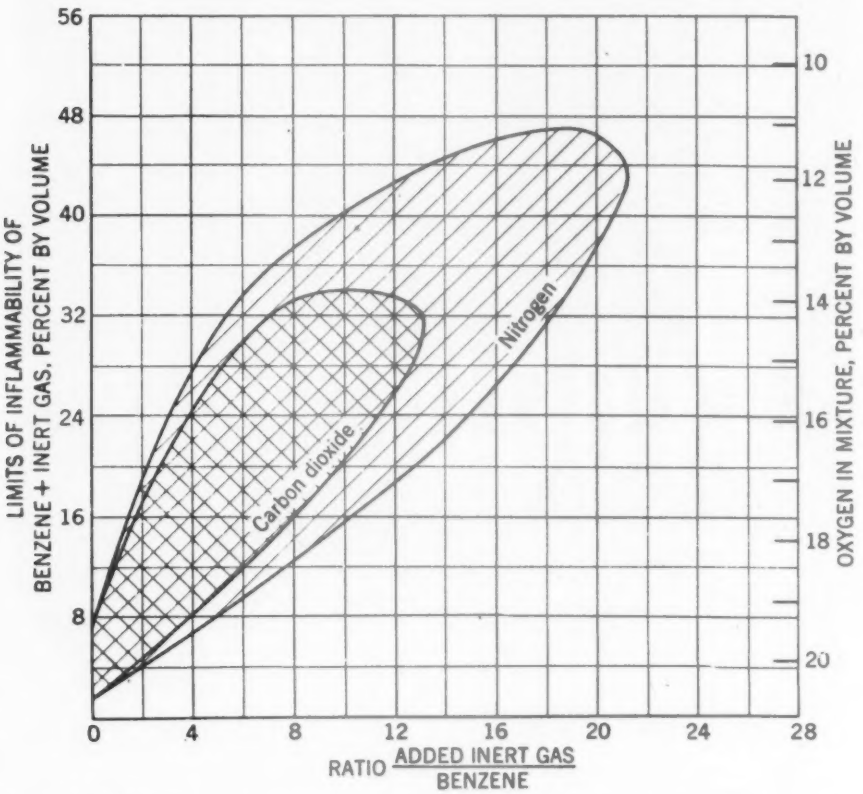

Fig. 1—Inflammability of benzene-air-nitrogen and benzene-air-carbon dioxide mixtures

portions. Data are shown graphically in Fig. 1. Similar data, using carbon dioxide as the inert gas, are given in Table 3 and also shown graphically in Fig. 1.

The limit mixtures obtained in these tests were used to define the entire range of inflammability of benzene-air-nitrogen and benzene-air-carbon dioxide mixtures. The shaded areas of Fig. 1 show these ranges. As indicated in the plot, the extinctive effect of carbon dioxide is greater than that of nitrogen—some 21.2 volumes of nitrogen per volume of benzene are required to render all mixtures noninflammable, while only 12.9 volumes of carbon dioxide are required for the same conditions.

The relationship between the concentration of benzene and the critical oxygen requirements for the prevention of explosions is shown in Fig. 2, which gives the inflammable area of all possible mixtures of benzene, air and added nitrogen or carbon dioxide. The report states (condensed):

The straight line *ad* represents the composition of mixtures of benzene and air with lower and upper inflammability limits, at *b* and *c*, respectively, of 1.40% and 7.10%. Addition of nitrogen or carbon dioxide lowers the oxygen concentration and narrows the inflammable range, as shown by the shaded areas.

When the oxygen content is reduced to 11.2% by addition of nitrogen, the lower and upper limits coincide and all possible mixtures of the three components become noninflammable. This mixture contains 2.5% benzene. Similarly, when carbon dioxide is added until the oxygen content is reduced to 13.9%, all mixtures of the components are noninflammable; benzene concentration at this point of minimum oxygen content is 3.5%.

The report gives the following additional information (condensed) on use of Fig. 2:

When the atmosphere contains 5.7% of benzene, the graph of Fig. 2 shows the oxygen concentration needs to be reduced to only 15.8% if nitrogen is used as the diluent to prevent flame propagation. However, this mixture will become inflammable if air is added, since addition of air causes the composition of the mixture to fall along the line *aj* to the left toward *a* and through a range of mixtures that are inflammable.

Non-Explosive Atmospheres

If the problem, when benzene-air mixtures are used, is to control the atmosphere so that the composition at all times is outside the inflammable area bounded by *bce* (when nitrogen is added as the diluent) or *bck* (when carbon dioxide is used), the figure enables determination at a glance of the hazards involved. Likewise, as indicated by point *j*, an atmosphere containing 14% oxygen and 8% benzene cannot explode until air is added.

However, if it is desired to remove the benzene without producing an explosive mixture, the atmosphere must be altered to pass around the explosive area. It becomes necessary to alter the composition of the atmosphere until it falls into the area to the left of the line *aef* when added nitrogen is used as the diluent, or *akg* when carbon dioxide is used as the diluent. It is not necessary to reduce the oxygen content to zero to pass safely from the composition given by point *j* to atmospheres given by any point to the left of *aef* or *akg*. Nitrogen can be added until the oxygen content drops below a value given at the point where *jh* crosses *aef*, or 5.7%, and the corresponding benzene value of 3.3% or less.

The composition of the atmosphere now is such that it cannot be rendered explosive no matter how much air is added, because a line drawn from any point in this area to *a* (the path the composition of the atmosphere takes when air is added) will not pass through the inflammable area. The graph thus indicates the explosive conditions of all mixtures of benzene, air and added nitrogen or carbon dioxide and permits these conditions to be determined merely by knowing the composition of the mixture.

Plots similar to that of Fig. 2 can be developed for other gases, using the prin-

TABLE 5—Inflammability Limits of Methane-Nitrogen and Methane-Carbon Dioxide Mixtures

Vol. N_2:	Limits of inflammability percent by volume		Vol. CO_2:	Limits of inflammability —percent by volume—	
Vol. CH_4	Lower	Upper	Vol. CH_4	Lower	Upper
0.0	5.0	15.0	0.0	5.0	15.0
0.5	7.5	19.0	0.5	8.0	18.5
1.0	10.5	23.0	1.0	11.0	22.0
1.5	13.0	26.0	1.5	14.0	24.5
2.0	16.0	29.0	2.0	17.0	27.0
2.5	18.5	31.5	2.5	20.5	29.0
3.0	21.0	34.0	3.0	24.0	30.5
3.5	24.0	35.0	3.3	28.0	28.0
4.0	26.5	37.0	3.4	Noninflammable	
4.5	29.5	39.0			
5.0	33.0	40.5			
5.5	36.0	41.5			
6.0	39.5	41.5			
6.1	Noninflammable				

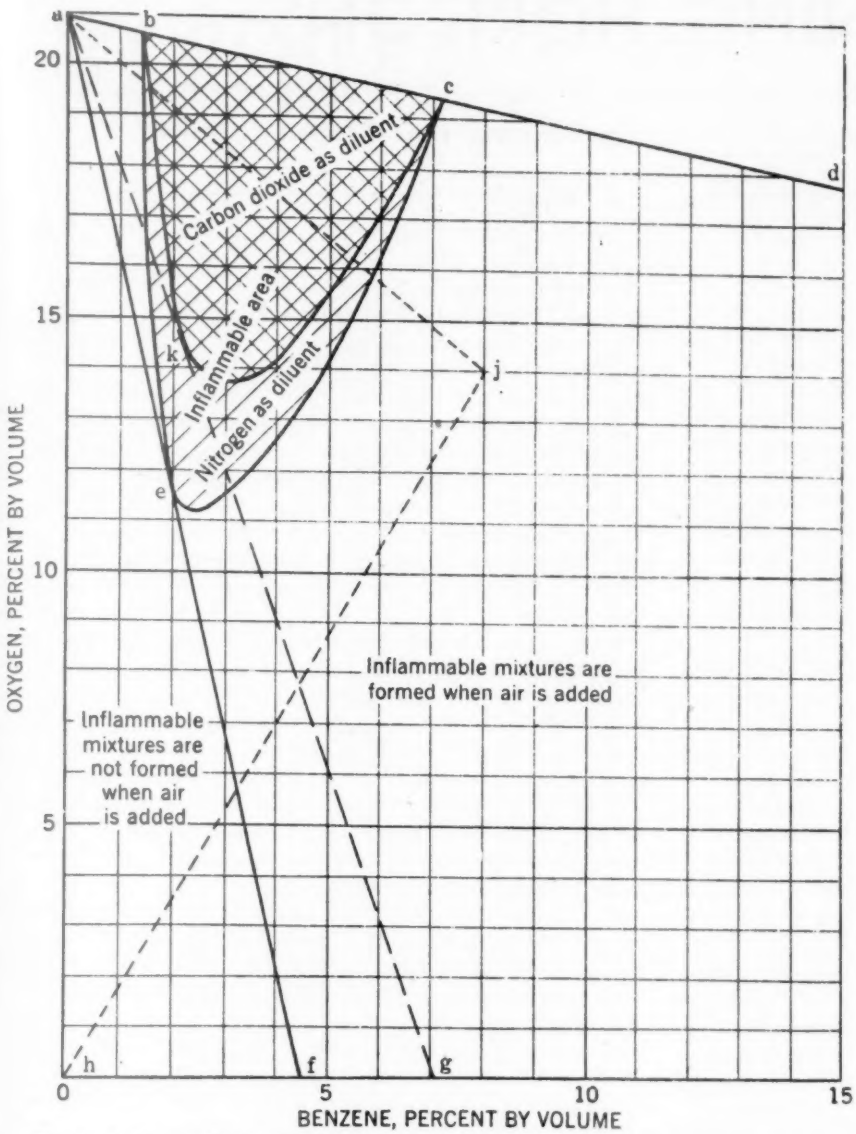

Fig. 2—Inflammability of benzene, air and added nitrogen or carbon dioxide

TABLE 6—Inflammability Limits of Ethane-Nitrogen and Ethane-Carbon Dioxide Mixtures

Vol. N_2 / Vol. C_2H_6	Limits of inflammability per cent by volume Lower	Upper	Vol. CO_2 / Vol. C_2H_6	Limits of inflammability per cent by volume Lower	Upper
0.0	3.1	12.5	0.0	3.1	12.5
0.5	4.8	13.6	0.5	4.8	15.6
1.0	6.2	20.4	1.0	6.4	18.6
1.5	7.8	22.8	1.5	8.0	21.2
2.0	9.3	25.6	2.0	9.7	23.2
2.5	10.9	27.7	2.5	11.3	25.2
3.0	12.6	29.7	3.0	12.9	27.2
3.5	14.1	31.6	3.5	14.8	29.0
4.0	15.6	33.3	4.0	16.7	30.5
4.5	17.2	34.8	4.5	18.5	31.5
5.0	18.9	36.0	5.0	20.4	32.4
5.5	20.4	37.2	5.5	22.6	33.3
6.0	21.8	38.3	6.0	25.4	34.1
6.5	23.2	39.4	6.5	27.8	34.8
7.0	24.9	40.3	7.0	30.8	35.5
7.5	26.4	41.3	7.3	35.7	35.7
8.0	27.9	42.1	7.4	Noninflammable	
8.5	29.5	43.0			
9.0	31.1	43.9	11.5	39.2	47.6
9.5	32.7	44.8	12.0	41.2	47.5
10.0	34.3	45.7	12.5	43.2	46.9
10.5	35.8	46.4	12.8	45.4	45.4
11.0	37.5	47.2	12.9	Noninflammable	

(*Continued in next column*)

ciples just discussed, the Bureau's report adds.

Calculated Inflammability Limits

It is possible also to calculate the limits of inflammability in air of complex combustible mixtures containing nitrogen and carbon dioxide making use of Le Chatelier's law, according to the Bureau report. In this case the simplest statement of the law is:

$$Limit = \frac{100}{\frac{P_1}{N_1} + \frac{P_2}{N_2} + \frac{P_3}{N_3} + \ldots}$$

where P_1, P_2, P_3 are the proportions of combustible gas present in the original air-free mixture, so that $P_1 + P_2 + P_3 + \ldots = 100$,
and, N_1, N_2, N_3 are the limits in air for each combustible gas.

If for P_1, P_2 and P_3 in the above equation there is substituted the "total per cent of component" and for N_1, N_2 and N_3 the "limits of component," the equation may be used for calculating the limits of inflammability of numerous types of industrial gases.

Tables 4, 5 and 6 give the limits of inflammability of various combustible gases when combined with varying amounts of added nitrogen or carbon dioxide. These may be used in computing by the above method the explosive limits of complex mixtures when diluted with varying amounts of one or the other of the two diluents.

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WIDENING HORIZONS

Views on Personnel, Management and Economic as Well as Technological Developments in Petroleum Refining and Natural Gas Processing: Comment from Readers Is Invited

Wartime Design Features For Normal Practice

THE operating record of the wartime refineries in this country is most impressive in view of the problems that were met and overcome in the design and construction of new processing units of varied types. Emergency conditions called for using substitute materials in place of certain grades of steel and other materials formerly employed. Shortages of various types of important equipment had to be overcome.

Some of the new processes installed were taken from the pilot-plant stage directly into commercial units to operate under conditions largely new in oil company experience, which also brought entirely new problems to the engineering staffs of oil companies and contractors.

The difficulties experienced in the design and construction of plants were overcome in the main by the same cooperative effort that brought the new processes themselves through such short periods of development before being put into actual practice. Information was exchanged by the oil companies and the refinery engineering firms in the wartime emergency. The Materials Division of the early Office of Petroleum Coordinator, with the cooperation of all groups of manufacturers, saw to it that the best possible use was made of available materials and equipment to speed the erection of plants in the 100-octane gasoline program.

These wartime experiences undoubtedly have brought about improvements in oil company practices which will be adopted by the companies in their conventional engineering codes. Some of the wartime features, even though not carried over in their entirety into normal practice, will probably have a material effect on future plant design.

One such benefit both to the oil companies and the manufacturers would seem to be the simplification of standards for some of the materials used. Before the war the design departments of many of the oil companies followed the practice of writing their own specifications, to meet their own individual needs. Their standards for materials used and the sizes required in many cases called on the manufacturers to make up individual orders, thus handicapping the latter's mill or plant operations. Frequently the materials thus specified, with only slight changes and with no loss in serviceability, could have been ordered in conformity with the manufacturers' standard practice.

Before the war, for example, many oil companies wrote their own specifications for chrome-alloy tubing. If the manufacturers did not want their bids thrown out, they bid on the items as specified. One manufacturer reported receiving 19 sets of specifications from various refiners, all coming within the normal range of refinery operating conditions for which these materials are employed. In the wartime emergency it was suggested by the OPC Materials Division that the general classifications of tubes be reduced to six in number, ranging from low carbon steel to 18% chrome, 8% nickel. As far as is known oil companies have not reported operating difficulties through conforming to this wartime practice.

From the oil companies' point of view, when normal practice is contemplated, it is recognized that simplification of standards can be overdone and undue work thrown on the plant shop. Plant efficiency can be impaired by using conventional items where actual requirements call for individual specifications. However, the cooperation between the oil companies, engineering firms and manufacturers in the wartime emergency will bring about lasting benefits in a trend toward sound simplification of standards for the most widely used refinery materials.

In the wartime emergency also, manufacturers' experience was called upon by some of the oil companies to a much greater benefit than previously. When it became necessary to use substitute materials in equipment and to save on steel and other metals in all possible ways, the engineering departments of the manufacturers were found to be invaluable guides as to what could be done without seriously impairing the efficiency of their equipment.

Some of the wartime conservation measures embodied suggestions the manufacturers had previously made. A steam boiler manufacturer, for example, suggested eliminating steel casings for boilers in refinery plants as unnecessary, and using insulating material in its place. He had advocated this change in oil company specifications for some years past, apparently without great results. When wartime refinery design called for the installation of pumps outside to save building a pump house, manufacturers suggested the climatic and other factors to be taken into consideration.

The design and construction engineers in general deserve great credit for their part in the refining industry's wartime program. The plants built under great handicaps in many cases have operated at above design capacity and various units have established records for continuous time on stream. Their performance has enabled the industry to adequately meet the war demands for vital petroleum products in tremendous volumes. It is logical that the sound improvements in plant engineering embodied in them should become conventional practice.

Guidance on the Research Problem

OIL companies face an acute problem in finding the means to carry on their research and development programs, even for some years after the war, due to the alarming shortage of research workers in training in the scientific schools of the country. The situation is more serious for the petroleum industry than for some others; for it has already learned to depend heavily on its research staffs for the methods and operating technique to improve its products. Also from these same groups are drawn a good proportion of the men who operate and manage its refineries.

The management of the oil companies, both large and small, will find this particular manpower bottleneck pressing for more and more of their personal attention in the future. Their understanding of the problem and of the general function of research in the petroleum industry will be improved through study of a volume now at hand entitled "The Future of Industrial Research." This book is a compilation of papers and discussions presented at the Forum of the Standard Oil Development Co. last October, the company making its 25th anniversary the occasion of a formal assembly on this subject. The speakers included C. F. Kettering, the late Thomas Midgley and other authorities on research in various lines of industry. The book could well be recommended reading for oil company executives.

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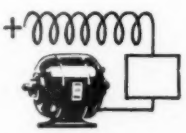

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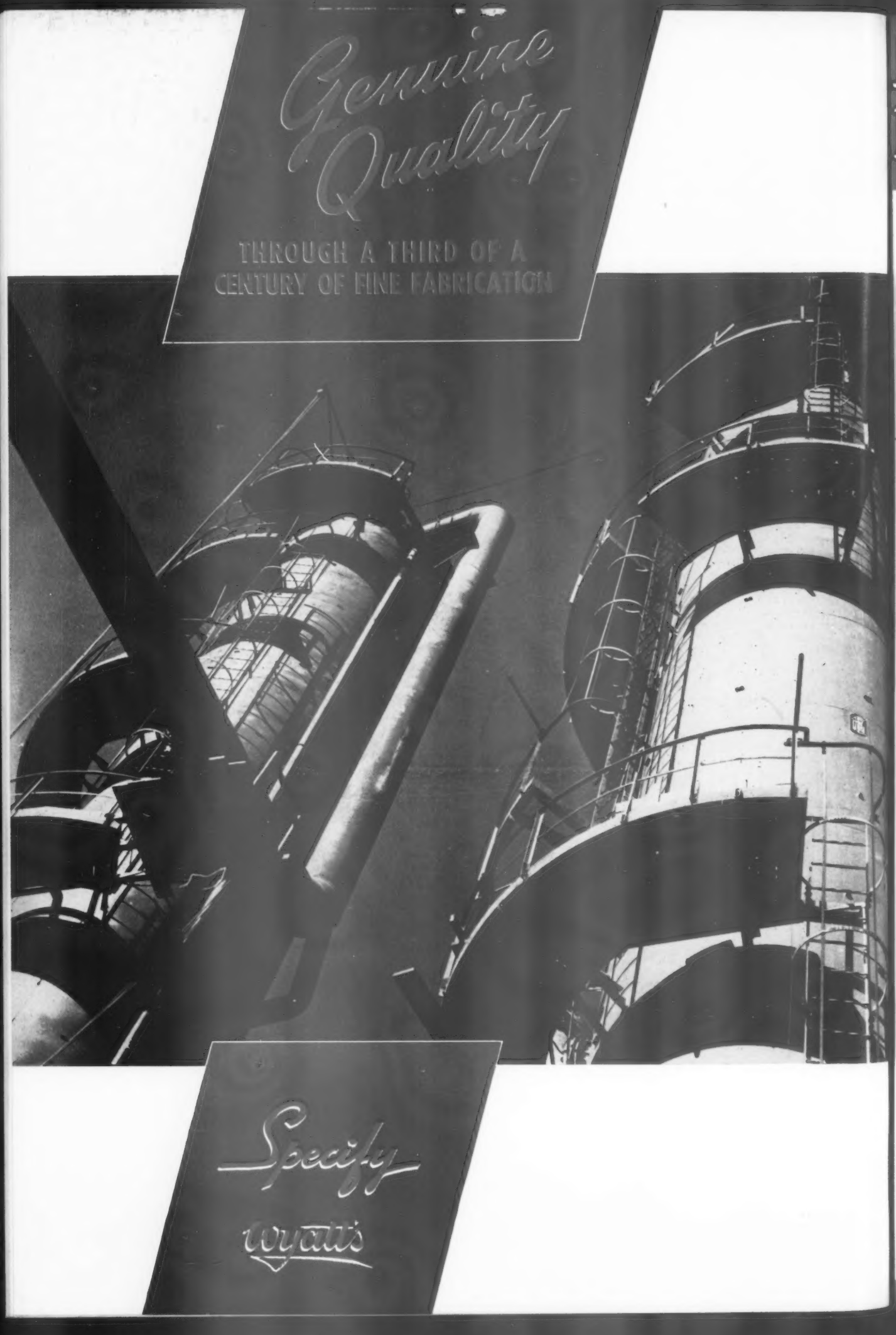
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